



4.041 Advanced Product Design

The Next 150 Year Chair

Syllabus — Spring 2022

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Where will our products be in 150 years?

4.041 is an **advanced product design studio** in which we will reimagine how we **design, make, use and reuse** products for living.

- In this studio, you will push the boundaries of what's possible in product design, dream, and invent new approaches to how we create furniture that tackles the **ecological challenges** of our time.
- By engaging **cutting-edge research** at MIT and beyond in **material intelligence**, **fabrication technology** and **recycling innovations**, you will **reimagine today's**

concepts of “sustainability”, for a more ecologically-responsible and digitally-enabled future.

- You will reinterpret and conceive of new typologies, **re-defining what “furniture” means from the ground-up.**

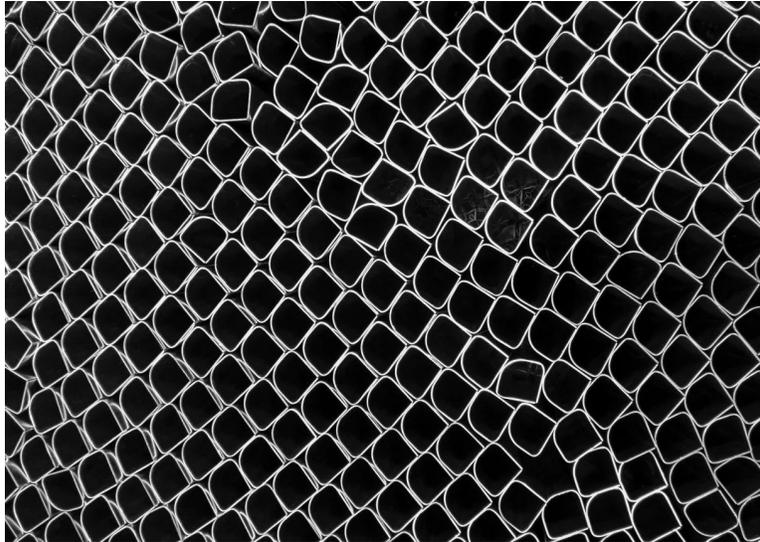


Image credit: Emeco

The studio will respond to a design prompt:

*“Design a piece of ‘furniture’ **and** its lifecycle for the next 150 years. Re-interpret, imagine, and create new concepts of what ‘sustainable furniture’ is, how it is manufactured, and how it will be used in the future.”*

Students will iteratively prototype their novel design concepts through hands-on making, document their work at a professional level, and ultimately present their products to peers, faculty and invited critics from industry leaders.

Phase 1: Concept Development

Overview

In the concept development phase of the studio, students will be invited to explore **novel methods** and **experimental technologies developed at MIT or elsewhere** as their potential mediums for design innovation. They will be invited to develop a **personal position on the ecological impact, design and manufacturing** of products.

▼ Deliverables

At the end of the phase, students will present:

- A specific area of interest for their project relating to **innovation in product lifecycles**.
- A series of design precedents (existing work) closely related to their topic.
- A concept for a novel furniture product (initial design studies).

▼ Learning Objectives

- Study precedents and state-of-the-art work.
- Practice speaking about and critiquing design.
- Hone in on a unique position on the studio topic.

1A: Precedent Research

2 weeks

In phase 1A, Students will conduct their own research on **cutting-edge design work** that inspires them. This will include gathering images and information, then engaging in critical discussion with peers and instructors. Students will research how design intersects with **new technology** to create **breakthroughs and advances in the way products are made**.

Students are encouraged to draw upon highly experimental techniques and technologies, or make their own cross-disciplinary bridges between seemingly unrelated phenomena and technological methods as sources for design inspiration and innovation. As such, it will be important to not only *present* design precedents, but to *give feedback* to peers to share ideas.

- ▼ Expand to see examples of research topics that students might explore.

- *“How can designers at MIT (and beyond) help to transform destructive habits in manufacturing and consumption, toward goals of carbon-neutrality?”*
- *“How can we use new, renewable or recycled materials to create furniture with a more optimal lifecycle?”*
- *“Can newly published engineering research open up the possibility of novel fabrication methods for furniture and products?”*
- *“Does emerging computer science afford us new opportunities to optimize the manufacturing or distribution of furniture?”*
- *“How do collectibility, scarcity and mass-customization affect the lifecycle of products?”*
- *“How can breakthroughs in computation, decentralized web, etc. offer a new platform for simulating or experiencing designs digitally?”*

1B: Developing a Product Concept

1.5 weeks

In the second part of phase 1, students will be asked to create a design concept whose material, fabrication or function builds upon the research gathered. The overall theme of the studio will focus on the design of a furniture product. Students are invited to rethink the concept, design and making of furniture. They are encouraged to work with **unusual physical phenomena, novel methods and experimental manufacturing technologies**.

The goal is to address various aspects of the product ranging from its interactive properties, shape, material, aesthetics, function or production process. At the end of the first phase, students will be asked to present their design **precedents** and their **final concept** (models and diagrams) for a novel furniture product that addresses the studio prompt.

Phase 2: Fabrication + Production

Overview

The second exercise explores processes of **fabrication** and **production** through the **making** and **testing** of the proposed furniture product. Students will be asked to further materialize their idea by producing iterations of their final concept from the first exercise.

▼ Deliverables

At the end of the phase, students will present:

- Physical prototypes of a furniture product design.
- Photographs and other documentation of iterations.
- An evaluation of how well the prototypes answer the central research questions of the studio (product lifecycle) and of the student's personal interest.

▼ Learning Objectives

- Practice design iteration (*create* → *receive critique* → *revise* → *repeat*).
- Develop knowledge of (and practice skills in) making and fabrication.
- Practice documenting one's own design process.

2A: Design Iterations

3 weeks

In design, “iterating” means: producing **variations** of a design, getting **feedback**, and then producing **more variations** in response. The most successful designers throughout history (and today) have used some version of this method to “narrow in” on designs that are valuable to customers, peers and to the world.

In this studio, students will have the opportunity to present their own design iterations, receive critique from peers and instructors, and give critique to others. Iterations start broad, and become more refined as the semester goes on.

Iterations will be presented in class in the form of **models**, **prototypes** and **physical experiments**. In an advanced design studio, **students are expected to develop a high level of craft** in their physical work (precision, good technique, appropriate use of materials).

▼ Physical Making

Through fabrication, students can make use of various machines and tools: 3D printing, laser cutting, CNC, woodworking, metal working, lamination, casting, molding etc.

Students are encouraged to invent their own **experimental processes** based on their research.

▼ Process Documentation

Throughout the process, students will be guided in documenting their work using **photography, video, sketches and diagrams**, etc. Using documentation, students will develop a strong and compelling narrative for their work, stemming from the studio theme and their specific area of research.

2B: Final Iteration + Presentation

2 weeks

After producing many prototypes of their designed products, students will produce a final version of the prototype.

They will be asked to test and evaluate how well it responds to the central questions of the research and of the studio, and how well it functions practically. They will be asked to show the **lifecycle** of their product, including its **inception, use** and potential **reuse** over time. It will be necessary for students to also evaluate their design's **ecological impact** based on common metrics, and share this with critics.

Students will present their iterations, final prototypes and evaluation to their peers, faculty and invited critics at the end of the phase. Students will practice presenting their work both **verbally** and **visually**.

Phase 3: Presentation

Overview

The last phase explores the **narrative, documentation and presentation** of the product. Students will refine their designs/prototypes and develop a presentation and narrative that addresses their specific research topic, the needs of users of their product, and the lifecycle of the product.

▼ Deliverables

These questions will be addressed through a public final exhibition that will include:

- The final iteration of the furniture product (**a physical prototype**)
- Images, video, digital assets or other multimedia content showing **precedents, iterations** and **process**
- A **verbal presentation** of the final product and process

▼ Learning Objectives

- Develop critical thinking skills about **representation** and **communication** of a design process.
- Learn how to effectively **engage an audience** in the verbal presentation of design work.
- Practice soliciting useful feedback from external **critics** and **industry experts**.
- Learn how to **professionally document** products using photography and video.

3A: Documentation

3 weeks

The way in which the product is presented is as important as the design and fabrication of the product itself. The class will document their final prototypes at a high level of quality, with the help of documentation experts and workshops in photography/videography. At the end of this phase, students will present documentation with a first pass at their verbal presentation, and will have an opportunity to get feedback from invited critics.

3B: Presentation — Finishing Touches

1 week

To effectively communicate their ideas to critics and users, students will have to refine their spoken narrative regarding the concept, explaining the implications of the work and specifically how the student has chosen to address their research topic.

Students will compile documentation into a visual presentation to accompany the verbal narrative, and will select the most relevant prototypes (including the final prototype) to

display during their final presentation.

▼ Expand to see examples of questions students might be asked by critics at the final presentation.

- *What is your unique vision for the future of furniture (the “big picture”)?*
- *Who are the users of the furniture throughout its lifecycle?*
- *What is the impact of this product on users, customers, manufacturers and the natural environment?*
- *How does this product contribute something novel to current research and industry practices?*
- *Please justify your design decisions throughout the semester.*
- *What were your design goals for this project? How do your process and final design achieve those goals?*

Subject Completion Requirements

Completion of each of the exercises, rigor in process, clarity in representation, as well as the overall progress of the semester (including attendance) will be fundamental to completing the subject. See below for a comprehensive outline of requirements.

▼ Evaluation Criteria

Below are the criteria used to evaluate student work. Please note that students are **graded based on all work done throughout the semester, not just the final presentation.**

1. **Thesis:** How clearly is the student articulating the conceptual intentions?
2. **Translation of Thesis:** How well is the student using their thesis to develop a design response to given problems?
3. **Representation Appropriateness:** How well-matched is their choice of representational means to their intentions?
4. **Representation Quality:** How accomplished are they with drawing, modeling, digital representation, craft, etc.? To what degree do their representations convey what they are intended to?

5. **Oral Presentation Skills:** How clearly are they presenting their ideas orally, whether at their desk, in class discussions, or to a more formal jury?
6. **Participation in Critique and Discussions:** How actively and how constructively are they involved in class discussions, both formally and informally?
7. **Response to Criticism:** How do they effectively take advantage of criticism from instructors, classmates and outside jurors?
8. **Auto-Critical Skills:** To what extent are they able to critique their own work regularly and effectively?
9. **Attendance:** See below.

▼ Grading

A: Excellent - Project surpasses expectations in terms of inventiveness, appropriateness, verbal and visual ability, conceptual rigor, craft, and personal development. Student pursues concepts and techniques above and beyond what is discussed in class.

B: Above Average - Project is thorough, well researched, diligently pursued, and successfully completed. Student pursues ideas and suggestions presented in class and puts in effort to resolve required projects. Project is complete on all levels and demonstrates potential for excellence.

C: Average - Project meets the minimum requirements. Suggestions made in class are not pursued with dedication or rigor. Project is incomplete in one or more areas

D: Poor - Project is incomplete. Basic skills including graphic skills, model-making skills, verbal clarity or logic of presentation are not level-appropriate. Student does not demonstrate the required design skill and knowledge base.

F: Fail - Project is unresolved. Minimum objectives are not met. Performance is not acceptable. This grade will be assigned when you have excessive unexcused absences.

▼ Attendance

- **Attendance for the full duration of each class is mandatory.**

The studio is an exceptional learning environment that requires your physical presence as well as your intellectual presence.

- **You are allowed three excused absences for the semester.**

An excused absence is defined as one that was discussed with and approved by the professor at least 24 hours prior to the date of absence, or a family or medical emergency that is confirmed by your physician or a dean in Student Support Services.

- **Absences beyond the three allotted will result in a decrease in your final grade.**

If you miss six or more studio classes, you will be asked to drop the subject or receive a failing grade.

▼ Studio Culture

Work in the studio will build sequentially. Therefore, your commitment to continual development is of paramount importance. It is important that you take advantage of the studio environment. You have been given a studio space; please use it.

Your development as a designer is made possible by the collective nature of the studio; working in studio, instead of at home, allows you to participate in the dialogue of the studio setting. Group reviews are collective to give every student the opportunity to engage with others, practice speaking about design, and give feedback. **This is a critical component of every studio course.**

▼ Academic Integrity

Massachusetts Institute of Technology students are here because of their demonstrated intellectual ability and because of their potential to make a significant contribution to human thought and knowledge. At MIT, students will be given unusual opportunities to do research and undertake scholarships that will advance knowledge in different fields of study. Students will also face many challenges. It is important for MIT students to become familiar with the Institute's policies regarding academic integrity, available at [Academic Integrity at MIT: A Handbook for Students](#).

▼ Safety

Fabrication can be dangerous. You will have the opportunity to use machines, tools and other methods of fabrication in MIT shops, but only once you have completed required safety trainings. If you would like to experiment with a new fabrication process, please reach out to your instructor about getting necessary trainings.

All safety protocols must be adhered to when using shop and fabrication spaces at MIT. If you don't know how to do something safely, just ask a supervisor or instructor. This is your opportunity to learn new methods, so you are not expected to know how to fabricate everything.

All spraying of fixative, spray paint or any other aerosol substance should be done in the shop and with proper ventilation. Adhesives and chemicals must be on the approved list provided in most shop spaces. If you can't find the list, ask a supervisor or instructor.

Security is a necessary component for a studio that is accessible to you and your colleagues 24 hours a day, 7 days a week. Storage spaces may be provided in studio and doors will be accessible using MIT card access.

All protocols and requirements related to COVID-19 safety must be followed in the studio and shop spaces. Please refer to [MIT's website](#) for full details as they are continually updated.

Student Resources

▼ Student Support Services

If you are dealing with a personal or medical issue that is impacting your ability to attend class or complete work, students should contact a dean in [Student Support Services \(S3\)](#).

These offices are here to help you. The deans will verify your situation, provide you with support, and help you work with your professor to determine next steps. In most circumstances, students will not be excused from coursework without verification from a dean. Please visit the S3 website for contact information and more ways that they can provide support.

▼ Disability and Accessibility Services

MIT is committed to the principle of equal access. **Students who need disability accommodations are encouraged to speak with Disability and Access Services (DAS), prior to or early in the semester so that accommodation requests can be evaluated and addressed in a timely fashion.** Even if you are not planning to use accommodations, it is recommended that you meet with DAS staff to familiarize yourself with the services and resources of the office. If you have already been approved for accommodations, please contact DAS early in the semester so that they can work with you to get your accommodation logistics in place. Please visit the DAS website for contact information.

▼ Diversity, Inclusion and Equity

MIT values an inclusive environment. I hope to foster a sense of community in this classroom and consider this classroom to be a place where you will be treated with respect. I welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. If this standard is not being upheld, please feel free to speak with me.

Schedule

* Guests join class

Week 1	2/1	Introduction
T	2/1	* 1A - Class Introduction - Emeco Introduction - Syllabus Review - Research prompt
R	2/3	* 1A - Review research - Group feedback

Week 2	2/8	Phase 1
T	2/8	1A - How to analyze and critique product designs - Group desk crits
	2/10	1A - Present research to date - 1B introduced - Materials sourcing assigned

Week 3	2/15	Phase 1
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Week 3	2/15	Phase 1
T	2/15	1B - Shop orientation 1 - Desk crits - Materials list approval
R	2/17	1B - Desk crits / work day

February 21, 2022 Presidents' Day — holiday.

February 22, 2022 Monday schedule of classes to be held.

Week 4	2/24	Phase 1 Presentations
R	2/24	* Phase 1 Presentations (Present 1A and 1B)

Week 5	3/1	Phase 2
T	3/1	Phase 2 Introduced
R	3/3	2A Shop Orientation 2

Week 6	3/8	Phase 2
T	3/8	2A Process Documentation Workshop
R	3/10	2A

March 14-18, 2022 Half-term subjects final exam period (H3).

Week 7	3/15	Phase 2
T	3/15	2A
R	3/17	2A Pinup 2B Introduced

March 21, 2022 Spring break begins.

March 25, 2022 Spring break ends.

Week 8	3/29	Phase 2
T	3/29	2B
R	3/31	2B

Week 9	4/5	Phase 2 Presentation
T	4/5	2B
R	4/7	* Phase 2 Presentation

Week 10	4/12	Phase 3
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Week 10	4/12	Phase 3
T	4/12	Phase 3 Introduced 3A Workshop Guest lecture
R	4/14	3A Final Documentation Workshop

April 18, 2022 Patriots' Day — holiday.

Week 11	4/19	Phase 3
T	4/19	3A
R	4/21	3A

Week 12	4/26	Pre-Final Review
T	4/26	3A
R	4/28	3A Pre-Final Review

Week 13	5/3	Phase 3
T	5/3	3B
R	5/5	3B

May 06, 2022 Subjects with no final exam — Undergraduate subjects: no test may be given and there may be at most one assignment due between this date and the end of the last scheduled class period in the subject.

May 06, 2022 Thesis due for degrees other than doctoral.

Week 14	5/10	Final Review
T	5/10	3B

May 10, 2022 Last day of classes.

Week 14	5/10	Final Review
T	Date TBD (5/13-5/18)	* Final Review

Last updated @February 1, 2022