

ARCH 541

MATERIAL SYSTEMS IN DESIGN

New Jersey Institute of Technology
Hillier College of Architecture and Design



Air Filtering Facade System
Manuel Gea Gonzalez Hospital, Mexico City



The Silk Pavillion
Mediated Matter Group - MIT Media Lab



Active Modular Phytoremediation Wall System
CASE (Center for Architecture, Science, and Ecology)

Course Syllabus

Type of Course: Architecture Elective in the Hillier College of Architecture and Design
Face-to-Face Seminar Format 3 credits, 3 contact hours per week
Prerequisite: Arch396

Course Description:

The use of materials in contemporary architecture has provided new territories for creative and innovative design. This paradigm shift is largely due to advancements in technology, building science, and the tools available to Designers for creative and technical production. There has been a predominant shift in architectural thinking through matter that has led to materials as a generative force in conceptualization and processes used in making contemporary architecture.

This seminar will allow students to examine material systems that give design agency to matter as a creative and technical force in the making of architecture. In doing so, it will provide students an opportunity to understand and explore the role material matters play in contemporary architectural theory and praxis. Focused on the exploration and understanding of material systems this course will provide students with the intellectual underpinnings for the re-conceptualization of matter within their own design processes.

As the profession of architecture has embraced materiality in a direct, pragmatic and performance based manner it has yet to shake the hylomorphic residue that accompanies a traditional approach to matter. The discipline of Architecture has recognized that matter is no longer subservient to form and this shift in thinking has provided new territories for research and innovative design. Students will be exposed to creative material practices and processes that have discarded traditional approaches to matter, using it as a catalyst for design, not as a means to substantiate design. This fundamental theoretical shift will allow students to study and expand their overall knowledge of material capacities for design within their own work. As a result, students will be exposed to emerging thought and methodologies that utilize materials in a primary role for design.

Course Learning Objectives:

- provide students an opportunity to understand and explore the role matter plays in contemporary architectural design, theory and praxis.
- provide an awareness and understanding of a variety of material systems in design, including but not limited to material pedagogy, processes and research.
- demonstrate and apply skills in academic research through collaborative group assignments, class discussions and individual writing assignments. Specific emphasis will be placed on the relationship of the built and natural environment, underscoring the responsibility the profession has to mitigate the challenges of climate change.

NAAB PROGRAM CRITERIA:

The National Architectural Accrediting Board accredits NJIT's architecture program. The NAAB has Shared Values of the Discipline and the Profession that must be covered by any architectural curriculum to attain their approval. This course satisfies the following shared values:

- **Design:** Architects design better, safer, more equitable, resilient, and sustainable built environments. Design thinking and integrated design solutions are hallmarks of architecture education, the discipline, and the profession.
- **Environmental Stewardship and Professional Responsibility:** Architects are responsible for the impact of their work on the natural world and on public health, safety, and welfare. As professionals and designers of the built environment, we embrace these responsibilities and act ethically to accomplish them.
- **Knowledge and Innovation:** Architects create and disseminate knowledge focused on design and the built environment in response to ever-changing conditions. New knowledge advances architecture as a cultural force, drives innovation, and prompts the continuous improvement of the discipline.
- **Lifelong Learning:** Architects value educational breadth and depth, including a thorough understanding of the discipline's body of knowledge, histories and theories, and architecture's role in cultural, social, environmental, economic, and built contexts. The practice of architecture demands lifelong learning, which is a shared responsibility between academic and practice settings.

Format:

As a seminar, the format presents one within the general framework of discussion and debate with your colleagues. Points of view are meant to be explored and examined within a critical forum of respect that is grounded in research, investigation and analysis. The course materials will provide a template for debate and a provocation to ask questions. It is within the act of questioning that the capacity of human thought evolves and deepens its insights. This course is not transmitting fixed canons of thought, but instead seeks to act as a provocation for thought and action in support of architectural design.

Course requirements will be comprised of class participation, individual position papers, case study projects, and a final paper. Unless otherwise indicated, for class discussion, students are required to be prepared to discuss required reading(s). Your preparation of readings should include summarizing the author's argument/thesis and highlighting the key architectural (etc.) + theoretical issues the article discusses. Points of view are meant to be investigated and tested, thus providing a point of departure for future thinking and action that can contribute to an emerging foundation of knowledge used by students in design of their own architectural projects.

Students will be required to demonstrate the ability to read, write, speak effectively in support of critically reasoned points of view. Students will be required to demonstrate the ability to gather, record, evaluate, and apply relevant information in architectural coursework and assignments.

Class Policy:

Class will meet once a week: Tuesday 2:30pm -5:20pm (subject to change)

Attendance is required at all class meetings. Unexcused absences can result in the lowering of final grades as it will impact the class participation grade. Three or more unexcused absences will require a meeting with the Instructor. Absence information can be found at the DOS website: <https://www.njit.edu/dos/student-absence-verification>

Learning and Teaching Culture Policy:

In addition to the overarching values and ethics of the university, the New Jersey School of Architecture is dedicated to optimism, diversity and solidarity, professional conduct, constructive evaluation and instruction, collaborative community, health and wellbeing, time management and school-life-work balance, respectful stewardship and space management, and well-rounded enrichment. The pedagogy of architecture and design is as complex as it is rewarding, and as dynamically evolving as the people who learn and teach it. This understanding resides at the core of the NJIT Learning and Teaching Culture Policy: <https://design.njit.edu/learning-and-teaching-culture-policy>

Evaluation and Grading Criteria: (subject to change during semester)

NJIT Undergraduate grading scale:

A	4.0	Superior
B+	3.5	Excellent
B	3.0	Very Good
C+	2.5	Good
C	2.0	Acceptable
D	1.0	Minimum
F	0.0	Inadequate

Incompletes are only granted in the event of a documented medical or family emergency, and must be approved by the instructor and administration.

NJIT has a policy of issuing mid-term warnings for students who are not performing at a satisfactory level.

Any student issued a warning will be required to have a conference with the instructor to evaluate satisfactory completion of the work for the remainder of the semester. At any point during the semester students can arrange to meet with the instructor to inquire how their performance of the assignments is progressing and how they may improve.

Academic Integrity:

NJIT has a University Code of Academic Integrity that will be upheld, and any violations will be brought to the attention of the Dean of Students. For more information visit: www.njit.edu/doss/policies/conductcode/index.php

Cheating and plagiarism will not be tolerated. The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students. All students are responsible for upholding the integrity of NJIT by reporting any violation of academic integrity to the Office of the Dean of Students. The identity of the student filing the report will remain anonymous. All students are expected to adhere to the University Code on

Academic Integrity: <https://www.njit.edu/dos/academic-integrity> and to the Code of Student Conduct: <https://www.njit.edu/dos/policies/conductcode/index.php>

HCAD librarian Maya Gervits has assembled excellent resources for a students use on using images, citing, and plagiarism: <https://researchguides.njit.edu/c.php?g=671665&p=4727920>

Assignments:

Each assignment will constitute a percentage of the overall grade as follows:

- Class attendance, readings and discussion participation, 25% of final grade
- Position Papers, 20% of final grade
- Case Study Research Project, 30% of final grade
- Final Paper, 25% of final grades

Class Discussion and Participation:

Unless otherwise indicated, for every section meeting, students are required to be prepared to discuss required reading(s) to facilitate and stimulate discussion. Your preparation of readings should include summarizing the Author's argument/thesis and highlighting the key architectural (etc.) + theoretical issues the article discusses. Students are required to look up any words or references with which you are not familiar.

Students should conduct basic research to situate the author and the argument in the appropriate socio-cultural or disciplinary context. Each week, specific students may be assigned to give an overview/summary of the readings and lead the subsequent discussion. Active participation in section discussions requires not only preparation before class, but also engaged listening during class. Active participation also means that you will not wait passively to be called on, but that you will contribute to the conversation by answering and asking questions for the duration of the class.

Position Papers:

Periodically students will be asked to write a position paper that reflects on the issues being raised in the required readings and class discussions. The paper requires students to take a position on an issue, showing how your position relates to those of the authors. Papers should be roughly 400(min) - 600(max) words. Papers should include the following; 1) Title, 2) a well defined topic-issue, 3) a clear individual position-point of view on the topic that is substantiated and/or clarified with material from the readings, and 4) word count.

Papers to be uploaded to CANVAS as a PDF using the following naming convention: lastname_firstname. Students should take the time to revise, edit, and proof-read each paper prior to uploading to CANVAS.

Case Study Research Project:

The Case Study Project is an opportunity for students to research, analyze and critique processes and design methodologies that utilize materials in a primary role for design. This assignment requires students to demonstrate the skills to gather, document, examine and evaluate research material in search of answering a hypothesis. This will require a sustained level of intellectual rigor over a sustained period of time. Full details will be posted on CANVAS for this assignment.

Final Paper:

The final paper is an opportunity for students to reflect upon and present an attitude towards the potential role material systems have in contemporary architectural design. Students are asked to synthesize and articulate a clear point of view that considers materials and material based design processes. Paper topics should be supported by documentation that clarifies-demonstrates individual points of view. Full details will be posted on CANVAS for this assignment.

Course Reference Readings and Materials

A series of readings will accompany individual assignments and can be found in the reserve texts located at the HCAD Library Permanent Reserve and as Ebooks on-line at <https://archlib.njit.edu/>. Supplemental readings that are not in the reserve texts will be posted on CANVAS or emailed to students.

Rachel Armstrong	<i>Soft Living Architecture: an alternative view of bio-informed practice</i> New York; New York :Bloomsbury, 2018
Blaine Brownell	<i>Material Strategies: Innovative Applications in Architecture</i> New York: Princeton Architectural Press, 2012
Edited by Gail Peter Borden and Michael Meredith	<i>Matter: Material Processes in Architectural Production</i> London and New York: Routledge, 2012
Nathaniel Coleman	<i>Material and Meaning in Architecture</i> London and New York: Bloomsbury Publishing Pic, 2020
Simone Ferracina	<i>Ecologies of Inception: Design Potentials on a Warming Planet</i> London ; New York : Routledge, 2022
Edited by David Gissen	<i>Territory: Architecture Beyond Environment: Architectural Design</i> United Kingdom: John Wiley and Sons Ltd., 2010
Edited by Sean Lally	<i>Energies: New Material Boundaries: Architectural Design</i> United Kingdom: John Wiley and Sons Ltd., 2009
Lewis, Paul, Tsurumaki, Marc, Lewis, Lewis, David	<i>Manual of Biogenic House Sections</i> Novato : ORO Editions : Goff books, 2022
Edited by Mostavafi, Moshen with Doherty, Gareth Harvard University GSD	<i>Ecological Urbanism</i> Zurich, Switzerland: Lars Muller Publishers and the President and Fellows of Harvard College 2010/2013
Edited by Thomas Schropfer	<i>Material Design: Informing Architecture by Materiality</i> Basel: Birkhäuser, 2011
Lars Spuybroek	<i>The Architecture of Variation</i> London: Thames and Hudson Ltd, 2009
Edited by Katie Lloyd Thomas	<i>Material Matters: architecture and material practice</i> London ; New York : Routledge, 2007
Katie Lloyd Thomas	<i>Building Materials: Material Theory and the Architectural Specification</i> London ; New York : Routledge, 2021

Additional References

Brownell, Blaine E.	<i>Transmaterial: a catalog of materials that redefine our physical environment</i> New York: Princeton Architectural Press, 2006
Brownell, Blaine E.	<i>Transmaterial 2: a catalog of materials that redefine our physical environment</i> New York: Princeton Architectural Press, 2008
Brownell, Blaine E.	<i>Transmaterial 3: a catalog of materials that redefine our physical environment</i> New York: Princeton Architectural Press, 2010
Fernandez, John	<i>Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction.</i> Architectural Press, 2005

Web Resources:

Center for Architecture, Science and Ecology	http://www.case.rpi.edu/
Material ConneXion	http://www.materialconnexion.com/
Material Collection GSD	https://www.gsd.harvard.edu/loeblibrary/collections/materials-collection/index.html

Contact Information:

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Preliminary Schedule (subject to change)

Week	Day / Date	Remarks
September		
I	Tue. 9/3	Introduction: Overview, Expectations and Goals Discussion: Why Matter matters? How has our relationship to Matter and Technology changed the discipline of Architecture?
II	Tue. 9/10	Discussion: Manuel Delanda "Material Evolvability + Variability" Discussion: Katie Lloyd Thomas "Architecture and Material Practice" (Introduction) Alan Chandler "A Philosophy of Engagement" Discussion: Gail Peter Borden and Michael Meredith "Foreign Matter" Part II: Matter Design Jason Payne "Raspberry Fields" Lisa Iwamoto and Craig Scott "Voussoir Cloud"
III	Friday 9/13 Tue. 9/17	Position Paper 1.0 Due: New Territories_Concepts for Matter in Design Discussion: Part III: Matter Processes David Benjamin "Open" Discussion: Part V: Matter Detail Enright and Griffin "Lightness"
IV	Tue. 9/24	Discussion: Part VI: Matter Ecology Kiel Moe "Matter is but Captured Energy" Discussion: Part IX: Matter Surface Thom Foulders "Diachronic Growth" Andrew Kudless "Bodies in Formation"
October		
V	Tue. 10/1	Discussion: Thomas Schropher "The Alternative Approach" Nathaniel Coleman "Material as Reality Preserve: History, Theory, Design"
	Friday 10/4	Discussion: Blaine Brownell "Material Strategies Introduction" Position Paper 2.0 Due: Design Strategies for Action Through Matter
VI	Tue. 10/8	Discussion: Katie Lloyd Thomas "Building Materials: Material Theory and the Architectural Specification" (Introduction, Chapter 6) Discussion: "Ecological Urbanism" Daniel Ingber "Bio-inspired Adaptive Architecture and Sustainability" Achim Menges "Performative Wood" Hoberman Associates "Adaptivity in Architecture"
VII	Tue. 10/15	Discussion: Rachel Armstrong "Soft Living Architecture: An Alternative view of Bio-Informed Practice" (Preface, Chapters 1+2)
VIII	Tue. 10/22	Materials Library Visit Case Study Project Assigned Case Study: Phase 1 Research Proposal Due Case Study: Phase 2 Workshop
November		
IX	Tue. 10/29	Case Study: Phase 2 Research, Documentation and Preliminary Analysis Due
X	Tue. 11/5	Case Study: Phase 3 Analysis Due
XI	Mon. 11/11 Tue. 11/12	Last Day to Withdraw from Class Case Study: Phase 4 Project Presentation Due
XII	Tue. 11/19	Thursday Schedule Class Discussion Phase 5 Case Study Booklet Due Final Paper Assigned
	Fri. 11/22	Final Paper Phase 1.0: Abstract Due via email (see assignment)
XIII	Tue. 11/26 Wed. 11/27 Thurs. 11/28	No Class (Thursday Classes meet) Discussion: Final Paper Phase 2: Outline - Bibliography Due via email (see assignment) Thanksgiving Break
December		
XIV	Tue. 12/3	Final Paper Workshop
XV	Tue. 12/10 Wed. 12/11	Discussion: What Next? Last day of Classes