Dalhousie University - School of Architecture
ARCH 5299.03 Technology Seminar
M2 Technology | Microclimate + Materials

Course Outline - Fall 2021

Classes: Tuesdays, 9.30am-12:30pm
Instructor: Brian Lilley
Guest Instructor: Aaron Outhwaite
Office and office hours: contact brian.lilley@dal.ca

Brightspace site: dal.brightspace.com
Teams site: **M2 Tech 21 - Lilley - Microclimate + Materials**
Zoom meetings will be arranged by invitation.

ACADEMIC INFORMATION

Calendar Description
This course focuses on an advanced topic in architectural technology. The topic changes from year to year. It may emphasize materials, environmental strategies, or building details.
FORMAT: Seminar RESTRICTIONS: Graduate students - Architecture

Additional Course Description
The Intention of this Technology Course is to examine Microclimates through Material Attributes and Material testing. A review of Passive Principles will inform the layered production of a composite material. Testing of Material attributes will be made (or simulated) as a basis for the Architectural Design of a Microclimate. Due to the pandemic conditions at this present time, shop activities will be replaced with readings, discussions, and simple experiments that help reveal beneficial relationships between materials and environmental factors. Keyword definitions:

Microclimate
/ˈmīkrōˌklīmət/ noun
Microclimates are described in terms of climatic variables, their temporal and vertical variability, as established by the balance equations that govern the exchange of radiation, heat, water, and other atmospheric constituents. Encyclopedia of Atmospheric Sciences (Second Edition), 2015

These environmental variables—which include temperature, light, wind, and moisture—provide meaningful indicators for habitat selection and other ecological activities. In seminal studies, Shirley (1929, 1945) emphasized microclimate as a determinant of ecological patterns in both plant and animal communities and a driver of such processes as growth and mortality of organisms.
Biotic Functions of Riparia, Robert J. Naiman, Henri Décamps, Michael E. McClain, Gene E. Likens, 2005

Material Attributes
Materials play a significant role in design, that is, material attributes (properties) define (or limit) performance. Most products need to satisfy some performance targets, which are determined by considering the design (specification) goals. The most popular way of screening / selecting materials is via the use of material selection charts or a material properties database.
Screening of Materials, Ali Jahan, Kevin L. Edwards, 2013

Course Structure

The course is structured in four parts, that examine in turn Passive Principles, Material Attributes, Material creation and testing, and Architectural Expression.

To begin, we will consider the various scales of the phenomena, from larger climate to local site condition. The question of 'how do we respond to these phenomena?' will be answered by examining strategies of harvesting, shielding, and porosity. We will be examining materials and assemblies in terms of attributes that directly respond to those strategies. We will be producing composite materials and testing their attributes (tbc -or a simulation) with guest instructor Aaron Outhwaite, a PhD candidate in Biopolymer Research, in the Faculty of Engineering. The final part will pose a simple microclimate design problem, to be addressed with data from the material testing phase, that will be the basis for the design of an assembly.

In exploring and researching these topics, we will be starting with readings across scales, and looking at particular case studies and architectural translations. To understand the phenomena in general terms, there will be the possibility for a number of smaller experiments (Harvesting, Shielding, Porosity) based on readily available materials. There will also be the opportunity to consider scripting as it applies to the problem – both pseudo-scripting and grasshopper / Ladybug, for example.

Learning Objectives

-Develop and show ability to research environmental factors and material attributes that contribute to the design translation of passive environmental principles

-Develop and show ability with material detail modelling and simulation that contribute to the performance of an assembly

-Develop an understanding of building performance from assembly detail to overall comprehensive design

Admun Design + Construction Studio

Integration with other Courses

This course coincides with the second Design Studio in the graduate program, occurring in the fall term. The last assignment allows the student an opportunity to use content from the Design Studio as a basis for the Microclimate Design exercise (optional, see below). As such it offers students an opportunity to work on a particular topic of design related to sustainable building: using Microclimate design to develop performance goals for responsive material assemblies. This process is useful as a form of design research contributing to sustainable, comprehensive design.

Assignment Description

The main assignment is a process logbook that accumulates the term's work consecutively over the term's four units. As a guide for content, Exercises and Readings will be given for each Unit on a weekly or bi-weekly basis. The process log is a format document (to match your portfolio size) that captures the term's activities. All included material should be clearly and concisely labeled so that the document is self-explanatory. Annotation that reflects on the exercises and big-picture applications are a requirement. Further Assignment description will be given with the Introduction of each Unit, including any Instructions for formatting and any more detailed rubrics for grading. Readings, lectures and course notes will be posted on the MS Teams site, on a regular basis. The option to record seminars is available by request.

Unit 1 - Material Strategies and Passive Principles -
In this unit, we will be examining a number of materials for their carrying capacity, their temporal variability, and usefulness for modifying microsystems. Students will examine and define a set of local environmental microclimate characteristics, and possible adaptions.

Unit 2 - Material Attributes and Selection -
This unit will be based on the work of Ashby and material selection tables. Each student will investigate inter-related factors of heat capacity, moisture transport, and filtering porosity for a number of materials; toward creating a composite material approach for a microclimate.

Unit 3 - Composite Materials creation and testing -
Together with guest instructor Aaron Outhwaite, this unit will focus on an experiment stacking or laminating materials with different attributes together, that will be effective in modifying microclimatic conditions. There will be a consideration of bio-materials as interstitial layers. Simple testing protocols will be defined and utilized, this will be a small-group project.

Unit 4 - Material and Microclimate Design –
The final unit will synthesize work from the previous units in the design of an assembly to effectively modify a local microclimate. The student will define the existing microclimate, the material selection attributes and arrangement, the architectural assembly, and predict the microclimate outcomes. The student may choose whether to integrate this with studio design work or examine a separate case.

Class Format

A MS Teams site for shared information and daily co-ordination; Zoom and Conceptboard for tutorials, experiments, and reviews. Brightspace for official announcements, assignment submissions, and grading.

Equipment and Supplies

We are putting together some materials for a send-out kit; otherwise materials required will be common: from recyclable items (like cereal boxes) or local stores.

Weekly Hours

For this three credit-hour course, an average of nine hours per week is expected for all course-related activities, including classes. If most of the students are spending substantially more time, please notify the instructor.

Schedule

Class times: Tuesday mid-day, 11am – 2pm (Halifax time) Note: classes referred to as studio will include in-class working time, to differentiate from seminars.

Unit 1	*Topic*
Week 1 – 14 Sept 21	Course Introduction, Material Strategies and Passive Principles *seminar*
Week 2 – 21 Sept 21	Key factors - microclimate site definition + tools, *studio*
Assignment 1 due:	27 Sept, 1pm - Brightspace dropbox
Week 3 – 28 Sept 21	Review and Unit 2 Intro

Unit 2	*Topic*
Week 4 – 05 Oct 21	Material Attributes and Selection, *seminar*
Week 5 – 12 Oct 21	Key factors - material attributes definition + tools, *studio*
Assignment 2 due:	18 Oct, 1pm - Brightspace dropbox
Week 6 – 19 Oct 21	Review and Unit 3 Intro

Unit 3	*Topic*
Week 7 – 26 Oct 21	Composite materials creation and testing, *seminar*
Week 8 – 02 Nov 21	Key factors – composite layers and test data, *studio*
Assignment 3 due:	15 Nov, 1pm - Brightspace dropbox
Week 10 – 16 Nov 20 (note: week 9 study week)	Review and Unit 4 Intro

Unit 4	*Topic*
Week 11 – 23 Nov 21	Material and Microclimate Design, *seminar*
Week 12* – 30 Nov 21	Key factors – material and assembly, microclimate outcomes, *studio*
Assignment 4 due:	06 Dec, 1pm - Brightspace dropbox
Week 13 – 07 Dec 21	Final Review
Assignment 5 due:	10 Dec - Brightspace dropbox

*Student ratings of instruction (SRI's) will be scheduled during the last class in Week 12, prior to the last review.

Unit 4 Presentation and Final Portfolio
The Unit 4 assignment will be presented in the last class of term and the portfolio will be submitted on the last day of term, providing a coherent document for the term's investigations. Information from the previous units to support the design work in Unit 4 will be mandatory for the last presentation.

General Reading

(list will be specified with assignment hand-outs, and checked for availability with the Sexton Library)

Passive Principles and Microclimate

Ford, Brian; Schiano-Phan, Rosa; Vallejo, Juan A, 2019. *The Architecture of Natural Cooling, Second Edition.* New York: Routledge.

Corner, Donald B., Fillinger, Jan C., Kwok, Alison G, 2017. *Passive House Details: Solutions for High-Performance Design.* New York: Routledge.

Meyer, Shawna Michelle, Meyer, Christopher Michael, Hemmendinger, Daniel, 2018. *Pamphlet Architecture 36: Buoyant Clarity*. New Haven: Princeton Architectural Press.

Yeang, Ken, 2019. *Saving The Planet By Design, Reinventing Our World Through Ecomimesis.* New York: Routledge.

Hausladen, G., Saldanha, M., and Liedl, P, 2012. *Building to suit the climate: A handbook*. Basel: Birkhauser.

Moe, Kiel, 2010. Thermally Active Surfaces in Architecture. New York: Princeton Architectural Press.

City of Copenhagen Report on Cloudburst proofing – Natural Drainage strategies

Materials, System and Structure

Bachman, Leonard, 2003. Integrated Buildings, The Systems Basis of Architecture. New York: Wiley.

Garcia, Mark, Guest Editor: AD July/August 2014. *Future Details of Architecture*. London: John Wiley and Sons.

General

Moe, Kiel. *Convergence: an Architectural Agenda for Energy,* 2013. New York: Princeton Architectural Press.

Schafer, R. Murray, 2013. Our Sonic Environment and The Soundscape. New York: Knopf.

McCullough, Malcolm, 2005. *Digital Ground: Architecture, Pervasive Computing, and Environmental Knowing.* Boston: The MIT Press.

Assessment

Components and Evaluation

A short description of components and their weights that will count toward the final grade.
For each component, details will be provided in the separate assignment outline.

Assignment 1: Material Strategies and Passive Principles	20%	individual	evaluated by instructor
Assignment 2: Material Attributes and Selection	20%	individual	evaluated by instructor
Assignment 3: Composite Materials creation and testing	20%	group	evaluated by instructor
Assignment 4: Material and Microclimate Design	20%	individual	evaluated by instructor
Assignment 5: Portfolio	20%	individual	evaluated by instructor

Attendance or Participation Requirements
Except by prior permission or SDA, attendance in each class is mandatory. There will be a brief meeting at the beginning of each class session for student feedback. Participation in all reviews is mandatory.

Mid-term Standing
Oral feedback will be delivered with assignment reviews; the student is expected to take notes and review with the instructor. Written feedback will be delivered if a student is borderline or failing at that point.

Guidelines for Citing Sources
Chicago Manual of Style: Author-Date Style. For details, see:
Chicago quick guide: http://tinyurl.com/chicago-quick-guide
Chicago Manual full guide: http://tinyurl.com/chicago-full

Solar Cooking Stations
David Wilson MIT, 2013

Submission of Assignments
For each assignment, a PDF of the work is to be submitted to the corresponding Brightspace folder. Assignments 1 through 3 are due on Mondays at 1pm, on the dates mentioned in the schedule above. Work for the summary assignment 4 (to include relevant work from the previous assignments) will submitted the day before the presentation, 07 Dec, 1pm. The final Portfolio submission is on the 11 December.

Criteria and Standards for Assessment
Standards will rely on the general descriptions in "University Grade Standards" below, unless otherwise stated in the assignment description.

Group Assignments
The third assignment will be a group assignment. All members of the group will receive the same grade.

Grading Format
The Course Instructor will review the final portfolio, after the assignments are reviewed. Final comments on the coursework will be given by request. Assignment grades will be issued privately to students through Brightspace, not posted.

University Grade Standards (Graduate)
The graduate grades below apply to the final grade for the course. Grades for individual assignments can include grades in the C and D range.

Grade	Grade Point	Percent	Definition
A+	4.30	90–100	Considerable evidence of original thinking; demonstrated outstanding capacity to analyze, translate, and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
A	4.00	85–89	
A–	3.70	80–84	
B+	3.30	77–79	Evidence of grasp of subject matter, some evidence of critical capacity, analytical ability, and creative translation; reasonable understanding of relevant issues; evidence of familiarity with the literature.
B	3.00	73–76	
B–	2.70	70–72	
F	0.00	0–69	Insufficient evidence of understanding of the subject matter; weakness in critical capacity, analytical skills and creative translation; limited or irrelevant use of the literature.
INC	0.00		Incomplete
W	neutral		Withdrew after deadline
ILL	neutral		Compassionate reasons, illness

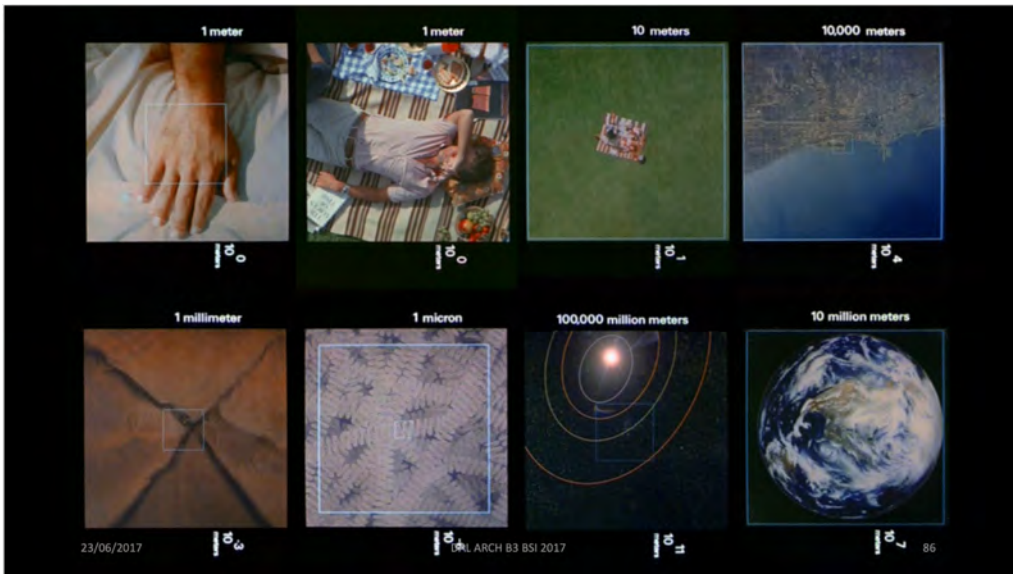
Course-Specified Policies

Late Assignments or Missed Tests
With a Student Declaration of Absence, a late assignment normally is accepted without a penalty. Without an SDA, the grade deduction per weekday is a third of a letter grade, e.g., from A to A–. Weekend days are not deducted.

Academic Integrity
Students are expected to submit original work.

CACB Student Performance Criteria
The MArch program enables students to achieve the accreditation standards set by the Canadian Architectural Certification Board. They are described at https://tinyurl.com/cacb-spc-2017 (pages 14–17). This Dalhousie ARCH course addresses the CACB criteria and standards that are noted on the "Accreditation" page of the School of Architecture website: https://tinyurl.com/dal-arch-spc.

Charles and Ray Eames, Powers of Ten



University Policies and Resources

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. See the School's "Academic Regulations" page (http://tinyurl.com/dal-arch-regulations) for links to university policies and resources:

- Academic integrity
- Accessibility
- Code of student conduct
- Diversity and inclusion; culture of respect
- Student declaration of absence
- Recognition of Mi'kmaq territory
- Work safety
- Services available to students, including writing support
- Fair dealing guidelines (copyright)
- Dalhousie University Library

Brian Lilley
July 2021