

# The University of Texas at Austin

## School of Architecture

### ENVIRONMENTAL CONTROL II

(the thermal environment + water systems,  
vertical transportation, fire protection and egress)

Unique Number: 00940 • ARC 384L & 00395 • ARI 384L

MW 0930 to 1100p SUT 2.114

M 0700 to 0800p SUT 2.114

#### **INSTRUCTORS:**

Adam Pyrek

Office: WMB 4.116A

Office hours: M 8:45 to 09:30a and by appointment

Telephone:

Email: [aapyrek@utexas.edu](mailto:aapyrek@utexas.edu) (Include ECII in the subject)

Charles Di Piazza

Office: BTL 114A

Office hours: W 11:00 to 12:00p and by appointment

Telephone:

Email: [cdp@austin.utexas.edu](mailto:cdp@austin.utexas.edu) (Include ECII in the subject)

#### **Teaching Assistant:**

Ken Sneed

Office hours: by appointment

Email: [kensneed@utexas.edu](mailto:kensneed@utexas.edu)

### **COURSE DESCRIPTION**

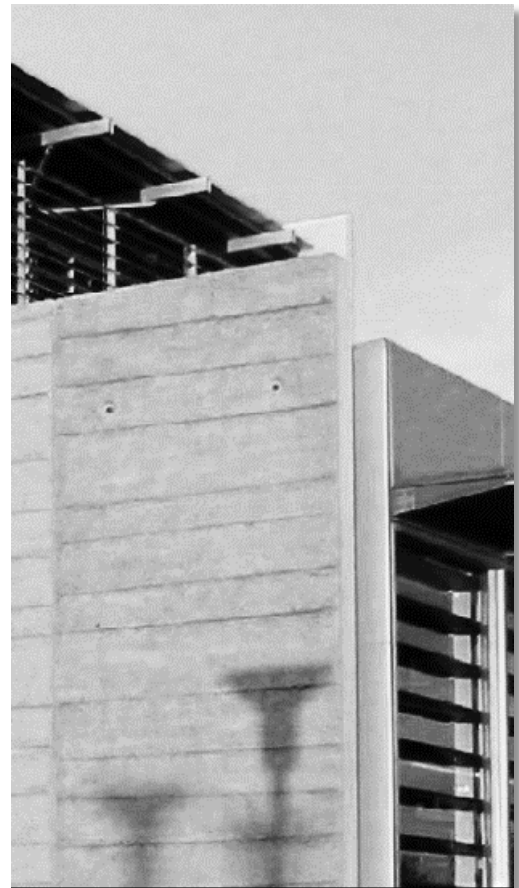
As a complementary course to EC I (illumination, electricity and acoustics), Environmental Control II will focus on the thermal environment, water systems and management, vertical transportation, fire protection and egress. The course will first establish a framework and a context for the technical components of buildings. These will include Environment, Resources & Energy; Site, Resources & Climate; Thermal Comfort; and the Design Process. Consequently, the various core topics of this course will be explored both individually and in relation to one another in order to develop students' approaches to systems integration in architecture. The assignments will encourage the students to explore the possible opportunities to find interrelationships between different systems and disciplines.

The course will survey traditional and free-running buildings as a background to contemporary approaches of mechanical and hybrid environmental control. Beyond learning about the industry standard systems and methods, students will become familiar with alternative ways of fulfilling project and code requirements. Case studies will be used in order to broaden the students' realm of possibilities in terms of system selection and the use of novel approaches to climate control for buildings. Other related topics such as the application of renewable energy technologies will also be covered.

One and one-half lecture hours twice per week and a one-hour lab once per week for one semester.

### **COURSE OBJECTIVES**

The objective of this course is for graduate students to acquire the understanding of the technical material that will allow them to become effective designers and project team-leaders. After this survey, they should be able to use critical thinking (with some imagination) in order to push the selection and application of environmental control



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systems beyond what is typically offered by the industry. This should ultimately lead to more design autonomy, a more seamless integration of systems, improved occupant comfort, and better performing, more environmentally sensitive projects.

Some of the specific objectives of this course are for students to be able to:

- ☐ Perform fundamental calculations relating to envelope heat flow, natural ventilation, rainwater collection...
- ☐ Have an in-depth understanding of the occupant's thermal comfort.
- ☐ Be familiar with the technical terminology needed for effective interdisciplinary communication.
- ☐ Recognize the importance of occupant behavior in the design of passive and mechanical systems.
- ☐ Have a critical understanding of the role of analytical tools used for thermal and energy simulations.
- ☐ Be familiar with the principles of water conservation and rainwater collection.
- ☐ Use case studies to expose students to real-world conditions and illustrate application of environmental principles in contemporary practices.

## NAAB CRITERIA

National Architectural Accrediting Board "requires an accredited program to produce graduates who: are competent in a range of intellectual, spatial, technical, and interpersonal skills; understand the historical, socio-cultural, and environmental context of architecture; are able to solve architectural design problems, including the integration of technical systems and health and safety requirements; and comprehend architects' roles and responsibilities in society."

The Student Performance Criteria as categorized under the NAAB Educational Realms that are addressed during the EC courses are listed here:

Primary: A.5. Investigative Skills, B.3. Sustainability, B.6. Comprehensive Design, B.8. Environmental Systems, B.10. Building Envelope Systems, B.11. Building Service Systems, B.12. Building Materials and Assemblies, C.2. Human Behavior, C.4. Project Management.

Secondary: A.1. Communication Skills, A.2. Design Thinking Skills, A.3. Visual Communication Skills, A.4. Technical Documentation, A.6. Fundamental Design Skills, A.10. Cultural Diversity, B.1. Pre-Design, B.2. Accessibility, B.4. Site Design, B.5. Life Safety, B.7. Financial Considerations, C.1. Collaboration, C.3. Client Role in Architecture, C.6. Leadership, C.8. Ethics and Professional Judgment, C.9. Community and Social Responsibility.

For more information reference: [www.naab.org](http://www.naab.org)

## FORMAT AND PROCEDURES

The course will consist of five complementary components: Lectures, Lab Sessions, Assigned Reading, Field Trips and Assignments/Quizzes/Tests. All components will cover and mutually reinforce the same subjects, but will focus on different aspects (theoretical, quantitative, hands-on, etc.). Effort will also be made to relate and integrate this course to the students' current studio work. The structured time for this semester will consist of 1-1/2 lecture hours twice per week and a 1 hour lab once per week. Required field trips with the class and the instructor will take place during the semester. Guest speakers will be invited in order to share their expert view and experience on specific topics.

The Canvas course management software will be used to distribute course materials, to communicate and collaborate online, to post grades, to submit assignments, etc. You can find support in using Canvas at the ITS Help Desk at 475-9400, Monday through Friday, 8 a.m. to 6 p.m.

<https://utexas.instructure.com/courses/633028/wiki/general-canvas-support-procedure>

## PREREQUISITE

Graduate standing and consent of the graduate adviser.

## TENTATIVE COURSE SCHEDULE

Schedule may be adjusted during the semester due to coordination with guest lecturers and/or trips. If the schedule is changed, students will be notified and the updated schedule will be posted on Canvas.

< SEE NEXT PAGE FOR THE TENTATIVE SCHEDULE >

<b><u>WK</u></b>	<b><u>DATE</u></b>	<b><u>TOPIC</u></b>
1	29-Aug	Course Introduction & Design Process
2	3-Sep	Labor Day - No Class
	5-Sep	Environment, Resources and Energy
3	10-Sep	Thermal Comfort
	12-Sep	Site, Resources and Climate
4	17-Sep	Envelope: Introduction & IAQ
	19-Sep	Envelope: Solar Geometry & Shading
5	24-Sep	Envelope: Heat Flow: Opaque Elements
	26-Sep	Envelope: Heat Flow: Fenestration
6	1-Oct	Passive EC Methods: Part 1
	3-Oct	Envelope: Moisture Control and Air Flow
7	8-Oct	Passive EC Methods: Part 2
	10-Oct	Passive EC Methods: Case Studies
8	15-Oct	Mechanical EC Methods: Introduction
	17-Oct	Mechanical EC Methods: Heating
9	22-Oct	Mechanical EC Methods: Cooling
	24-Oct	Mechanical EC Methods: Ventilation
10	29-Oct	Mechanical EC Methods: HVAC
	31-Oct	Case Studies
11	5-Nov	Hybrid EC Methods
	7-Nov	Fire Protection
12	12-Nov	Water Systems and Management Part 1
	14-Nov	Conveying Systems
13	19-Nov	Water Systems and Management Part 2
	21-Nov	Thanksgiving Holiday
14	26-Nov	Case Studies
	28-Nov	Field Trip or Guest Lecturer
15	3-Dec	Field Trip or Guest Lecturer
	5-Dec	Life-Cycle Lecture
16	10-Dec	Review

## EVALUATION CRITERIA

### GRADED WORK

Students will be evaluated on the following work:

ASSIGNMENTS **50.0%** (#1&2-10%; #3&4-15%)

LAB WORK **15%**

QUIZZES **15%**

IN-CLASS EXAM **10.0%**

WRITTEN EXAM **10.0%**

Bonus point may be earned by students for exemplary work or class participation at the instructor's discretion.

### ASSIGNMENTS, QUIZZES, AND EXAM

There will be (4) assignments during the semester: Assignment #1 - Site and Climate Analysis; Assignment #2 - Shading Study - Including a Physical Model; Assignment #3 - Passive Methods - Design and Calculations; Assignment #4 - Mechanical Methods and Energy Modeling

All assignments will be listed on Canvas with the final due dates. All completed assignments will be submitted digitally via Canvas (by midnight on the due date). Do not email assignments as attachments! Due dates are tentative and may be adjusted in order to allow for coordination with students' studio work. Teams will be assigned by the instructor. Quiz dates may be adjusted and given at any time and will cover the assigned reading, lecture material, labs and class discussions. There will be a comprehensive exam at the end of the semester (covering assigned reading, lecture material, labs and class discussions). The exam will divide into an in-class section and a take-home written section.

### GRADING CRITERIA

#### A Grade Work:

- ☐ Has a concept that is innovative and original
- ☐ Is comprehensive and very well developed
- ☐ Shows in-depth understanding of the subject matter including the assigned text
- ☐ Includes exemplary supporting figures, graphs and/or models
- ☐ Is well written and well supported by cited references

#### B Grade Work:

- ☐ Has a concept that is strong
- ☐ Is comprehensive and developed
- ☐ Shows understanding of the subject matter including the assigned text
- ☐ Includes appropriate supporting figures, graphs and/or models
- ☐ Is well written and well supported by cited references

#### C Grade Work:

- ☐ Has a concept
- ☐ Is developed
- ☐ Shows understanding of the subject matter
- ☐ Has adequate figures, graphs and/or models
- ☐ Is well written with and is supported by cited references

#### D Grade Work:

- ☐ Fulfills some of the assignment requirements
- ☐ Is not developed
- ☐ Shows some understanding of the subject matter
- ☐ Has inadequate figures, graphs and/or models
- ☐ Is not written well and has too few relevant cited references

#### F Grade Work:

- ☐ Does not fulfill the assignment requirements
- ☐ Is not developed
- ☐ Does not show understanding of the subject matter
- ☐ Has no relevant figures, graphs and/or models
- ☐ Is not written well. Has no relevant references or references are not cited

Each of 5 categories is worth 20%. Use Modern Language Association (MLA) format for citations. Assignments without citations **will not receive a passing grade.**

## FINAL GRADE CRITERIA

UT LETTER GRADE      EC MINIMUM SCORE

<b>A</b>	<b>93.33</b>
<b>A-</b>	<b>90</b>
<b>B+</b>	<b>86.67</b>
<b>B</b>	<b>83.33</b>
<b>B-</b>	<b>80</b>
<b>C+</b>	<b>76.67</b>
<b>C</b>	<b>73.33</b>
C-	70
D+	66.67
D	63.33
D-	60
F	0

### LAB WORK

Lab sessions will be held during the scheduled time on Monday nights. Some of the lab assignments will be graded and will account for **15%** of the semester's grade. Many of the labs will complement a graded assignment. Students should be able to complete the work during the scheduled time.

### DEADLINES

Each student may hand in ONE assignment (7) calendar days late ONCE during the semester. Consequently, assignments will be reduced by 5% for each school day that they are late. Credit for work turned in late due to non-scholastic reasons should be discussed with the instructor before the due date. Agreed-upon proof of the reason needs to be provided by the student.

### ATTENDANCE AND PARTICIPATION

Students are required to attend and participate in all lectures. Attendance may be taken at any time. Students need to notify the instructor **in advance** by **email** if they cannot attend a lecture. Absent students must complete the assigned reading and familiarize themselves with the content of the missed lecture. Three **(3)** unexcused absences (not due to illness, or to authorized University activities) will result in a deduction of a letter-grade from the student's final grade. Students need to attend labs, many of which will contribute to a graded assignment, or will count toward a lab grade.

Students are expected to fully participate during class and labs, and need to bring a calculator, pencil/pen and paper in order to perform quick calculations when required. (Calculator: Any type will do, and does not need to be scientific. Phone with a calculator will do. Laptops don't count).

Students are not to use electronic devices such as laptops, tablets or phones during the lectures without prior approval from the instructor. Students will need a **phone or other portable electronic device** with the **Canvas Student App** installed in order to take **quizzes and final exam in class**.

### ASKING FOR ASSISTANCE

Each student is expected to ask for assistance when needed. This can take place right after class, or students may schedule additional time to meet with the instructor or the TA at a later date, preferably during office hours.

## TEXTS

### REQUIRED TEXTS:

Grondzik, Walter T.; Kwok, Alison G.; Stein Benjamin; Reynolds, John S. *Mechanical and Electrical Equipment for Buildings*, 12th Edition. Wiley, 2014.

Heschong, Lisa. *Thermal Delight in Architecture*. MIT Press, 1979.

Required reading for a lecture will be assigned at the end of the previous lecture. Additional reading may be assigned at that time. Check Canvas each week for required readings.

### RECOMMENDED TEXTS:

These texts are held on reserve at the Architecture and Planning Library, or available as an Electronic Resource through the UT Library:

Addington, D. Michelle. *Smart Materials and New Technologies: For the Architecture and Design Professions*. Amsterdam ; Boston : Architectural Press, 2005.

Allen, Edward; Iano, Joseph. *The Architect's Studio Companion: Rules of Thumb for Preliminary Design*, 4th Edition. Wiley, 2006.

Arvind Krishan, et al. *Climate Responsive Architecture*. New Delhi ; New York : Tata McGraw-Hill Pub. Co., 2001.

Bachman, Leonard R. *Integrated Buildings: The Systems Basis of Architecture*, New York : J. Wiley & Sons, 2003.

Bradshaw, Vaughn. *Building Control Systems*, 2nd Edition. New York : Wiley, 1993.

Bluyssen, Philomena M. *The Indoor Environment Handbook : How to Make Buildings Healthy and Comfortable*. London, Sterling, VA : Earthscan, 2009.

Bobenhausen, William. *Simplified Design of HVAC Systems*. Wiley, 1994.

Daniels, Klaus. *The Technology of Ecological Building*. Birkhauser, 1995.

Daniels, Klaus. *Low-Tech, Light-Tech, High-Tech*. Birkhauser, 1998.

Fanger, P.O. *Thermal Comfort*. McGraw Hill, 1970.

Givoni, Baruch. *Passive and Low Energy Cooling of Buildings*. Van Nostrand Reinhold, 1994.

Lechner, Norbert. *Heating, Cooling, and Lighting: Sustainable Design Methods for Architects*, 3rd Edition. Wiley, 2009.

Mendler, Sandra. *The HOK Guidebook to Sustainable Design*. Hoboken, N.J. : J. Wiley, 2006.

McDonough, William. *Cradle to Cradle : Remaking the Way We Make Things*. New York : North Point Press, 2002.

Rush, Richard D. *The Building Systems Integration Handbook*. New York : Wiley, 1986.

Watson, Donald. *Climatic Design: Energy-Efficient Building Principles and Practices*, New York ; St. Louis : McGraw-Hill, 1983.

Yeang, Ken. *Ecodesign : A Manual for Ecological Design*. London : Wiley, 2006.

### ON-LINE RESOURCES:

ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE):

[www.eere.energy.gov](http://www.eere.energy.gov)

WINDOWS AND DAYLIGHTING GROUP, LAWRENCE BERKELEY NATIONAL LABORATORY:

[windows.lbl.gov](http://windows.lbl.gov)

ENERGY STAR (A joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy):

[www.energystar.gov](http://www.energystar.gov)

THE COMMITTEE ON THE ENVIRONMENT (COTE)

[network.aia.org/CommitteeontheEnvironment/Home](http://network.aia.org/CommitteeontheEnvironment/Home)

THE HESCHONG MAHONE GROUP, INC.

[www.h-m-g.com/downloads/Daylighting/order\\_daylighting.htm](http://www.h-m-g.com/downloads/Daylighting/order_daylighting.htm)

PVWATTS (Performance Calculator for Grid-Connected PV Systems)

<http://pvwatts.nrel.gov/>

BUILDINGGREEN, INC.

<http://www.buildinggreen.com>

## **UNIVERSITY POLICIES**

### **UNIVERSITY OF TEXAS HONOR CODE**

The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fair-ness, and respect toward peers and community.

Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. For further information, visit the following sites: Student Judicial Services web site <http://deanofstudents.utexas.edu/sjs/>; University Honor Code <http://www.txstate.edu/honorcodecouncil/>

#### **STUDENTS WITH DISABILITIES**

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact Services for Students with Disabilities at 471-6259 (voice) or 232-2937 (video phone).

#### **DOCUMENTED DISABILITY STATEMENT**

Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (video phone).

- Please notify the instructor as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course packets are not readable for proper alternative text conversion, etc.).
- Please notify the instructor as early in the semester as possible if disability-related accommodations of any kind are required. For field trips, advanced notice will permit the arrangement of accommodations on the given day (e.g., transportation, site accessibility, etc.).
- Contact Services for Students with Disabilities at 471-6259 (voice) or 1-866-329-3986 (video phone) or reference SSD's website for more disability-related information:  
<http://diversity.utexas.edu/disability/contact-us/>

#### **CLASS WEB SITES AND STUDENT PRIVACY**

Web-based, password-protected class sites will be associated with all academic courses taught at the University. Syllabi, handouts, assignments and other resources are types of information that may be available within these sites. Site activities could include exchanging e-mail, engaging in class discussions and chats, and exchanging files. In addition, electronic class rosters will be a component of the sites. Students who do not want their names included in these electronic class rosters must restrict their directory information in the Office of the Registrar, Main Building, Room 1. For information on restricting directory information, see the General Information Catalog or go to: <http://www.utexas.edu/student/registrar/catalogs/>

#### **RELIGIOUS HOLIDAYS**

By UT Austin policy, the student must notify the instructor of pending absence at least fourteen days prior to the date of observance of a religious holy day. If the student must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, she/he will be given an opportunity to complete the missed work within a reasonable time after the absence.

#### **EMERGENCY EVACUATION POLICY**

Occupants of buildings on the UT Austin campus are required to evacuate and assemble outside when a fire alarm is activated or an announcement is made. Please be aware of the following policies regarding evacuation from the Office of Campus Safety and Security, 512-471-5767, <http://operations.utexas.edu/units/csas/>:

- Familiarize yourself with all exit doors of the classroom and the building. Remember that the nearest exit door may not be the one you used when you entered the building.
- If you require assistance to evacuate, inform me in writing during the first week of class.
- In the event of an evacuation, follow instructions of class instructors.

Do not re-enter a building unless you're given instructions by the Austin Fire Department, the UT Austin Police Department, or the Fire Prevention Services office.

- Behavior Concerns Advice Line (BCAL): 512-232-5050
- Link to information regarding emergency evacuation routes and emergency procedures can be found at: <http://emergency.utexas.edu/>