

The University of Texas at Austin

School of Architecture

ENVIRONMENTAL CONTROL I (Illumination, Acoustics & Electricity)

Unique Number: 00990 • ARC 384K & 00370 • ARI 384K
MW 10:30 to 12:00p SUT 2.114
M 07:00 to 08:00p SUT 2.114

INSTRUCTORS:

Adam Pyrek
Office: WMB 4.116A
Office hours: M 9:45 to 10:30a and by appointment
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Email: apyrek@utexas.edu (Include ECI in the subject)

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Teaching Assistant:

Ken Sneed
Office hours: by appointment
Email: kensneed@utexas.edu

COURSE DESCRIPTION

The core topics of Environmental Control I consist of Illumination, Acoustics, and Electricity. (This course complements EC II: Thermal environment, water systems and management, vertical transportation, fire protection.)

Each core topic will be covered by first exploring its fundamental principles such as physics of light, sight and hearing. Consequently the topics will be closely examined individually, as well as in relation to the other topics covered during this semester, and when relevant, in EC II. An example of this would be the relationship between daylighting and thermal comfort, or acoustics and natural ventilation. Throughout the semester, the content of the lectures will also be put into context that will include site and urban factors, climate and culture, energy and environment, and codes.

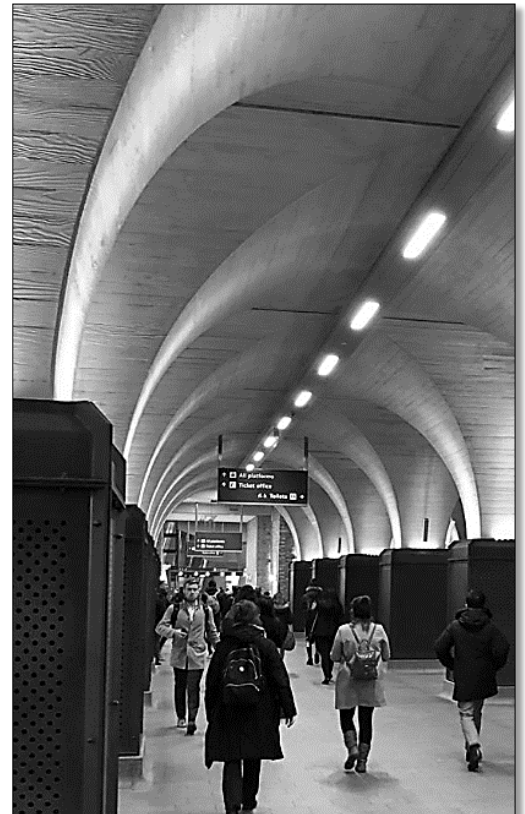
Beyond learning about today's industry standard systems and methods, students will become familiar with alternative ways that can allow them to go beyond fulfilling basic project and code requirements.

COURSE OBJECTIVES

The objective of this course is for graduate students to acquire an understanding of the technical material that will allow them to become effective designers and project team-leaders. Following this survey, students should be able to use critical thinking in order to push the selection and application of environmental control systems beyond what is typically offered by the industry. The acquired knowledge and skills in this course should ultimately lead to more design autonomy; a more seamless integration of systems; improved occupant comfort; and better performing and more environmentally sensitive projects.

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

- Have an in-depth understanding of lighting and architectural acoustic fundamentals
- Perform fundamental calculations relating to illumination and acoustics



London Bridge Station | Grimshaw Architects | Photo: S. Sonner

- Be familiar with the technical terminology needed for effective interdisciplinary communication
- Recognize the importance of occupant behavior in the design of daylighting and electrical illumination
- Have a critical understanding of the role of analytical tools (physical and digital) relating to the topics covered
- Have a basic understanding of utilization of electricity in buildings (principles, materials, systems, renewable technologies)
- Have a basic understanding of signal systems (security, communication, control and automation)

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 I course are listed here:

Primary: A.3. Investigative Skills, B.6. Environmental Systems (daylighting, solar systems, lighting systems, and acoustics), B.3. Codes and Regulations, B.9. Building Service Systems (lighting, electrical, communication, security), C.2. Integrated Evaluations and Decision-Making Design Process, C.3. Integrative Design, D.2. Project Management

Secondary: A.1. Professional Communication Skills, A.2. Design Thinking Skills, A.3. Investigative Skills, B.4. Technical Documentation, A.4. Architectural Design Skills, A.8. Cultural Diversity, B.1. Pre-Design, B.2. Site Design, C.1. Research, B.7. Building Envelope Systems and Assemblies, B.8. Building Materials and Assemblies, B.10. Financial Considerations, D.1. Stakeholder Roles in Architecture, D.4. Legal Responsibilities, D.5. Professional Conduct.

For more information reference: www.naab.org

FORMAT AND PROCEDURES

The course will consist of five complementary components: Lectures, Lab Sessions, Assigned Reading, Field Trips and Assignments/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 may 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://canvas.utexas.edu/>

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 >

TENTATIVE SCHEDULE:

DATE	ACTIVITY	TOPIC
23-Jan	INTRO/LECTURE	Course Introduction
28-Jan	LECTURE	Lighting Fundamentals: Physics of Light
30-Jan	LECTURE	Acoustics: Introduction & Fundamentals
4-Feb	LECTURE	Lighting Fundamentals: Light and Sight
6-Feb	LECTURE	Acoustics: Sound in Enclosed Spaces
11-Feb	LECTURE	Lighting Fundamentals: Quantity & Quality of Light
13-Feb	LECTURE	Acoustics: Building Noise Control
18-Feb	LECTURE	Lighting Fundamentals: Color
20-Feb	LECTURE	Acoustics: Building Noise Control
25-Feb	LECTURE	Daylighting: Introduction
27-Feb	Field Trip/Guest Lec.	Guest Speaker and/or Site Visit
4-Mar	LECTURE	Daylighting: Site and Building Form Strategies
6-Mar	Field Trip/Guest Lec.	Guest Speaker and/or Site Visit
11-Mar	LECTURE	Daylighting: Aperture Strategies
13-Mar	LECTURE	Light Sources
18-Mar	NO CLASS	SPRING BREAK
20-Mar	NO CLASS	SPRING BREAK
25-Mar	LECTURE	Daylighting: Aperture Strategies
27-Mar	LECTURE	Electricity
1-Apr	LECTURE	Artificial Lighting - Introduction & Light Fixtures
3-Apr	LECTURE	Electricity (Inc. Renewable Energy Tech.)
8-Apr	LECTURE	Artificial Lighting - Introduction & Light Fixtures
10-Apr	LECTURE	Signal Systems
15-Apr	LECTURE	Artificial Lighting - Applications
17-Apr	Field Trip/Guest Lec.	Guest Speaker and/or Site Visit
22-Apr	LECTURE	Artificial Lighting - Applications
24-Apr	LECTURE	Daylight / Artificial Lighting Integration
29-Apr	Review	Review
1-May	LECTURE	Daylight / Artificial Lighting Integration
6-May	LIGHT FIXTURE	Light Fixture Show and Discussion
8-May	No Class	Studio Reviews

EVALUATION CRITERIA

GRADED WORK

Students will be evaluated on the following work:

ASSIGNMENTS	50.0% (#1-15%; #2-20%; #3-15%)
LAB WORK	15%
QUIZZES	15%
EXAM (Questions and Calculations)	10.0%
EXAM (Written Short Answers)	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 (3) group assignments during the semester (teams will be defined by the instructor):

- Assignment #1 - Existing Space Acoustical Analysis
- Assignment #2 - Existing Space Daylighting Study (including Daylight Physical Model)
- Assignment #3 - Luminaire Design and Construction

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.

Quizzes will be administered using the **Canvas Student** App (See below), and may be giving anytime during class time.

There will be two comprehensive exams at the end of the semester (covering assigned reading, lecture material, field trips, labs and class discussions)

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 the 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

A	93.33
A-	90
B+	86.67
B	83.33
B-	80
C+	76.67
C	73.33
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. Subsequently, 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, PARTICIPATION, AND EQUIPMENT

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 need to bring to class a device that is capable of running the **Canvas Student app**. This can be a phone or tablet with an internet connection. Contact the instructor if you are not able to do so. Students are **not to use electronic devices** such as laptops, tablets or phones during the lectures without prior approval from the instructor (except when required for quizzes or as calculators).

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.

Tanizaki, Junichiro. *In Praise of Shadows*. Leete's Island Books, 1977.

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.

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.

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

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

Egan, M. David. *Architectural Acoustics*. New York : McGraw-Hill, 1988.

Egan, David M. *Concepts in Architectural Lighting*. McGraw-Hill, 1983.

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

Long, M. *Architectural Acoustics*. Elsevier Academic Press New York, 2005

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

Moore, Fuller. *Concepts and Practice of Architectural Daylighting*. New York : Van Nostrand Reinhold, 1985.

Phillips, Derek. *Daylighting : Natural Light in Architecture*. Amsterdam : Elsevier, 2004.

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

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

OTHER RESOURCES:

ILLUMINATING ENGINEERING SOCIETY:

www.ies.org

NATIONAL COUNCIL OF ACOUSTICAL CONSULTANTS:

www.ncac.com

ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE):

www.eere.energy.gov

WINDOWS AND DAYLIGHTING GROUP, LAWRENCE BERKELEY NATIONAL LABORATORY:

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

THE COMMITTEE ON THE ENVIRONMENT (COTE)

network.aia.org/CommitteeontheEnvironment/Home

THE HESCHONG MAHONE GROUP, INC.

www.h-m-g.com/downloads/Daylighting/order_daylighting.htm

DAYLIGHTING PATTERN GUIDE (New Buildings Institute in partnership with the University of Idaho and University of Washington)

patternguide.advancedbuildings.net

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 Student Judicial Services web site:

<http://deanofstudents.utexas.edu/sjs/>.

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/>

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://catalog.utexas.edu/general-information/>

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:

- 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.