



Arch 515L
ADVANCED ENVIRONMENTAL SYSTEMS

Units: 4

Term—Day—Time: Fall, Thursday, 6:30 PM – 9:50 PM

Location: Watt Hall, #212

Instructors: Joon-Ho Choi

Office: Watt Hall room #318

Office Hours: Tuesday, 1:00PM - 2:00 PM.

Contact Info: joonhoch@usc.edu

(email will be responded to within 48 hours).

Class Assistant: Ivan Alberto Monsreal Pinon

Office: Watt Hall, 3rd floor, MBS corner

Office Hours: Wednesday 5:00PM to 6:00PM

Contact Info: monsreal@usc.edu

Course Description

This course covers practical knowledge of passive and active environmental control strategies in heating, ventilating and air-conditioning (HVAC) systems, lighting and acoustic systems, building design performance and diagnostics, and human factors related to building indoor environmental quality. The course is intended to give the students both a fundamental and practical knowledge of building environmental control systems and strategies in thermal, air quality, lighting, and acoustic conditions in large and small buildings. It also provides a working knowledge of many of the interrelated building systems necessary to support human physiological benefits: environmental comfort and health effects. Much of the material covered in this course will help to prepare the student in a direct way for the building environmental (system) design.

Learning Objectives/Outcomes

- 1) Students will learn fundamental building physics, related environmental control system, and environmental design strategies.
- 2) Students will understand the principle of indoor environmental quality and its impact on building occupants health and productivity, as well as environmental satisfaction.
- 3) Students will learn how to identify and define the steps in environmental control and design, with consideration of the impact of thermal, air, lighting, acoustic, and spatial quality on building performance.
- 4) Students will learn how to estimate the energy load in a building caused by heat transmission, infiltration, ventilation, and internal heat gain.
- 5) Students will learn how to design a HVAC system and its layout for a low-/high-rise building.
- 6) Students will learn how to integrate building façade, mechanical, lighting, and control systems with consideration of energy performance and indoor environmental quality.

Prerequisite(s): N/A

Co-Requisite(s): N/A

Concurrent Enrollment: N/A

Recommended Preparation: N/A

Course Notes

Lecture notes, a syllabus, handouts, reading assignments, and any other course materials will be posted on Blackboard.

Teaching Method: This class will be conducted as a seminar and will mix lecture presentations by the instructor with student presentations, class demonstrations, slide presentation, project reviews, and guest speakers, as well as site-visit. Required texts and several reference books will be recommended to supplement coursework.

Grading: Final grade averages shall be determined using a weighted average of all required work. The weight distribution is as follows:

- Examinations (55%): Three examinations
 - Test #1: 15%
 - Test #2: 20%
 - Final (Test #3) : 20%
- Deliverables (40%): Homework (20%), Projects (20%)
- Extra Credits & Attendance (5%)

Extra-credits: There will be extra credit problems, assignments or test participation. These extra problems or assignment to help those students who feel that there is a need to improve their grade by performing some extra work.

Textbook (required):

Mechanical and Electrical Equipment for Buildings by Walter T. Grondzik, Alison G. Kwok, Benjamin Stein and John S. Reynolds (12th Edition)

**Additional papers and handouts will be provided.*

Required Readings and Supplementary Materials

- ASHRAE Performance Measurement Protocols (PMP)
- ASHRAE 55 Standards: Thermal Comfort - 2013
- ASHRAE 62.1 Standards: Ventilation for Acceptable Indoor Air Quality – 2013
- ASHRAE 62.2 Standards: Ventilation for Acceptable Indoor Air Quality - 2013
- ASHRAE High-Performance Building Handbook
- ASHRAE 90.1 Standard - 2013
- Illuminating Engineering Society (IES) Handbook – 2010
- See course schedule (p. 6) for detailed weekly readings.

Description and Assessment of Assignments

Students' learning outcomes will be assessed based on :

- Quality of the assignment/project
 - o How well a correct solution is found per the given question/problem.
 - o How accurately a numeric estimation is calculated.
 - o How clearly are project goals and objectives articulated.
 - o How well are the structure project framework and analytical methods used.
- Performance on quiz/exam.
- Timely submission.

Assignment Submission Policy

Deliverables are defined as any work required from the student that was assigned for acquisition or preparation outside of the regular classroom, e.g. web-based reference documents, homework, take-home quizzes, and projects. All deliverables are mandatory and due at the beginning of class on the required due date. Failure to submit a deliverable on-time and reasonably well attempted shall result in a deduction of 50% of the assigned point value, with an additional 10% deducted for each full-day late until such work is delivered into the instructor's possession, properly completed. Any deliverable not properly submitted within one calendar week of a required due date may result in a failing grade to the student in this course. Any student who may be absent from class on the due date may submit their work beforehand directly to the instructor, or, on the due date via another student. Exceptions to this policy shall be considered with adequate justification.

Grading Scale

Course final grades will be determined using the following scale

- a. 97.0 - 100 = A+ Students in this range will get an A and commendation (the university does not give A+)
- b. 93.0 - 96.9 = A
- c. 90.0 - 92.9 = A-
- d. 87.0 - 89.9 = B+

- e. 83.0 - 86.9 = B
- f. 80.0 - 92.9 = B-
- g. 77.0 - 79.9 = C+
- h. 73.0 - 76.9 = C
- i. 70.0 - 72.9 = C-
- j. 67.0 - 69.9 = D+
- k. 63.0 - 66.9 = D
- l. 60.0 - 62.9 = D-
- m. <60.0 = F

Grading Timeline

All of the submitted assignment/homework/take-home quizzes will be graded within 7 days and returned during class in the following week.

Additional Policies

Quality: All deliverables shall be graded for quality and content, 60% and 40% respectively. Chaotic, illegible, disorganized deliverables shall negatively impact the course grade.

Attendance: On-time attendance is expected in this course as is required in professional practice. Late arrival and repeated absences shall negatively impact the course grade.

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP: http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, (www.usc.edu/scampus or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>. Information on intellectual property at USC is available at: <http://usc.edu/academe/acsen/issues/ipr/index.html>.

Discrimination, Sexual Assault and Harassment

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/departments/departments-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Religious Holidays

The University of Southern California recognizes the diversity of our community and the potential for conflicts involving academic activities and personal religious observation. The University provides a guide to such observances for reference and suggests that any concerns about lack of attendance or inability to participate fully in the course activity be fully aired at the start of the term. As a general principle, students should be excused from class for these events if properly documented and if provisions can be made to accommodate the absence and make up the lost work. Constraints on participation that conflict with adequate participation in the course and cannot be resolved to the satisfaction of the faculty and the student need to be identified prior to the drop/add date for registration. After the drop/add date the University and the School of Architecture shall be the sole arbiter of what constitutes appropriate attendance and participation in a given course.

Respect for Diversity

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The

university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421

studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710

studentaffairs.usc.edu/ssa

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on-call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

Arch 515 SCHEDULE OF CLASSES

WEEK	DATE	LECTURE	CLASS	PROJECTS	READING ASSIGNMENT (Textbook pages)	ASSIGNMENTS
1	23-Aug	1-1	Introduction		Chapter 1 (pp. 3-29)	#1
		1-2	Building and environment			
		1-3	Unit conversion 1			
2	30-Aug	2-1	Unit conversion 2		Handout	#2
		2-2	Building science			
3	6-Sep	3-1	Indoor Air Quality	#1: HOBO	Chapter 5 (pp.129-138)	#3
		3-2	Thermal comfort			
4	13-Sep	4	Psychrometric chart / PMV Calculation		Chapter 4 (pp.109-127)	
5	20-Sep	5	Guest Lecture 1 (Dr. Gideon Sushuman, Associate, Buro Happold Engineering)			
			Test #1			
6	27-Sep	6-1	Heating load calculation 1		Chapter 7 (pp.224-229)	#4
		6-2	Heating load calculation 2			
7	4-Oct	7-1	Cooling load calculation 1		Chapter 10 (pp. 359-364)	#5
		7-2	Cooling load calculation 2			
8	11-Oct	8	HOBO presentation	#2: Research Proposal	Handout	Take-home quiz
9	18-Oct	9	MBS Travel Week			#6
10	25-Oct		Test #2			
11	1-Nov	11-1	Duct system design		Chapter 12 (pp.480-489)	#7
		11-2	Pipe system design			
		11-3	Daylight calculation			
12	8-Nov	12-1	Site Tour (4:00 PM)		Chapter 16 (pp.728-729)	#8
		12-2	Lumen methods (6:30PM)			
13	15-Nov	13-1	Project #2 Presentation 1	#2 Course Project submission)		
		13-2	Project #2 Presentation 2			
14	22-Nov	(THANKSGIVING BREAK)				
15	29-Nov	15-1	Physiological benefits + Cost-benefit analysis, Acoustic environment, Noise and sound absorption		Handout Chapter 22 (pp.1015-1028)	
		15-2	Wrap-up			
16	6-Dec	7-9pm	Final exam			