USC School of Architecture

Arch 315:
Design for the Luminous and Sonic Environment

Units: 3

Term – Day – Time:
Spring 2023 – Tuesday, Thursday, 2:00 pm – 3:20 pm

Location: Harris Hall 101 / Gin Wong Conference Center (HAR101)

Instructors: Lauren Dandridge-Gaines, Elizabeth Valmont-Harrington, Marc Schiler
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https://usc.zoom.us/j/7563527159
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Class Assistants: Najiyya Nadir Siddiqui, Shreya Satodia
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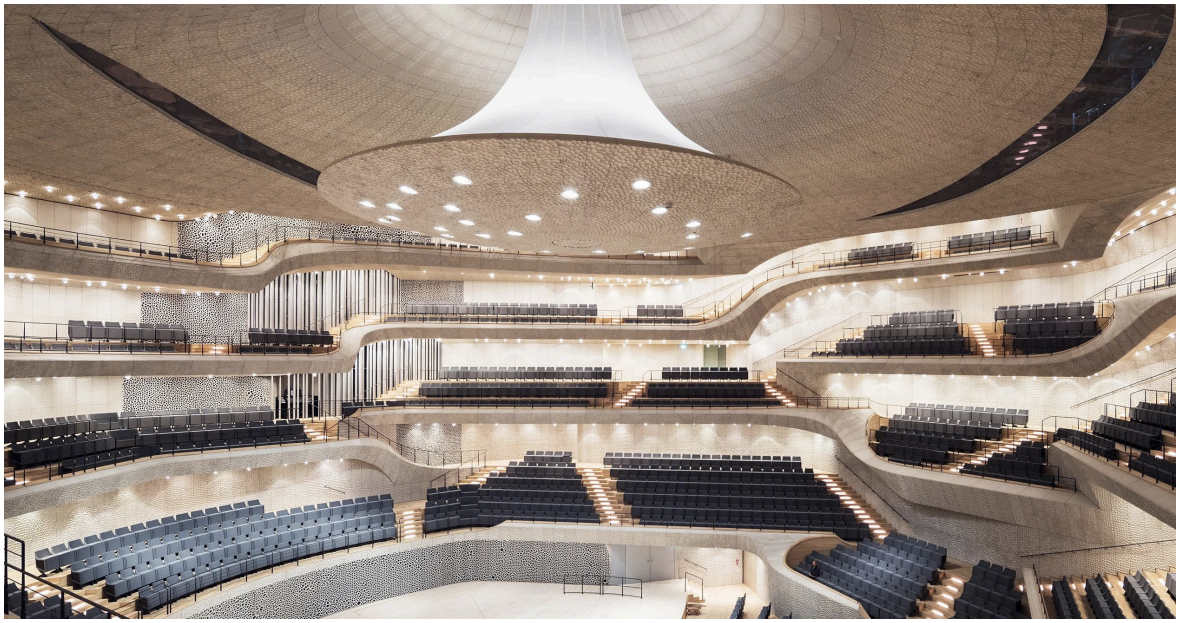

Figure 1- ***Elbphilharmonie daylit concert hall, by Herzog and de Mueron, Hamburg***
(photo Iwan Baan) https://www.wired.com/2017/01/happens-algorithms-design-concert-hall-stunning-elbphilharmonie/

Course Description

Architects deal with a broad spectrum of constraints and opportunities when designing or thinking about design. Much of the way that a building is experienced relates to the Environment created by the building, both within and without. This is especially true in terms of light and sound. The interaction between occupant and building is almost entirely filtered through those two sensory media. This course deals with those channels, their perception, their effect, and how the designer controls or manipulates those experiences. It is necessary to understand the processes, the perceptions, and the materials and tools with which we work.

Certain similarities exist in the behavior of these systems and the behavior of thermal systems which we discussed last semester, simply because they are natural physical functions.
Near the end of the semester, we will also consider topics such as mechanical, electrical and plumbing systems, designing for fire safety, and building accessibility. These systems are also critical performance issues for the building They can be less form determinate and normally set limits, they are still critical in the performance of each building, both for life safety reasons and as a necessary part of our professional responsibilities to the building users.

Learning Objectives

Students will learn the theory and science of the processes related to lighting and acoustics. They will learn the terms, resources, equipment and procedures which enable them to design safe, productive, equitable and even exhilarating spaces in terms of lighting and acoustics, basic electrical systems, plumbing systems, fire safety, conveyance and accessibility requirements in buildings.

The course will provide the knowledge required for the practice of Architecture as required by the National Architectural Accreditation Board (NAAB). This is more clearly defined in the detailed Accreditation Statement found at the end of the syllabus.

Prerequisite(s): ARCH 215 or permission of instructor
Co-Requisite(s): NA
Concurrent Enrollment: NA
Recommended Preparation: NA

Course Notes and Logistics

The material will be divided into three basic segments:
I. Lighting
II. Acoustics
III. Building Engineering Systems

The class will be primarily a series of lectures, demonstrations, assignments and quizzes or tests to determine what is being comprehended and what needs more work.

The homework assignments are graded, but the grade does not count in he total. It is beneficial to have done the homework because the quizzes and prelims will be similar in content. Remember, doing and understanding the material will be much more beneficial than just having copied it into your notes.

Copies of the syllabus, homework, and other announcements may be found on the class blackboard website.

Technological Proficiency and Hardware/Software Required

All necessary programs and simulations will be provided and taught within the course. A substantial course "handbook" is provided. There are recommended texts.

Required Readings and Supplementary Materials

Required "Text": The ARCH 315 handout is available online through Blackboard. (Download an electronic copy to have available in the future. You will need your own copy during exams.)

1.) Arch 315 Class Handout

Supplementary texts (***not** required*, access through library or online, or purchase used. Lectures will be posted and should be sufficient with Handout):

1.) Norbert Lechner; *Heating, Cooling, Lighting: Sustainable Design Methods for Architects, 4th Edition,* ISBN: 978-1-118-58242-8, 720 pages, September 2014
2.) Walter T. Grondzik, Alison G. Kwok, *Mechanical and Electrical Equipment for Buildings, 12th Edition;* ISBN: 978-1-118-61590-4, or 978-0-470-19565-9, 1856 pages, September, 2014.
3.) M. David Egan, *Architectural Acoustics,* J. Ross Publishing Classics, ISBN-13: 978-1932159783, ISBN-10: 1932159789, 448 pages, 2007.
4.) Marc Schiler, *Simplified Design of Building Lighting*, ISBN: 978-0471192107 or 0471192104, 1992

The only required text is the class handout. But *Mechanical and Electrical Equipment for Buildings* (MEEB) is used as a reference and a backup for this class just as it was for Arch 215: Design of the Thermal Environment. It is an excellent reference for now, and for the remainder of your career. *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*, is a slightly more accessible book, for those who have trouble with the engineering approach in MEEB. *Simplified Design of Building Lighting* covers all of the basic lighting principles with extensive examples and review questions. *Architectural Acoustics* does the same for Acoustics. The class handout is a large collection of tables and useful graphs and information, necessary for answering questions on the quizzes and exams, and in your future.

The handouts should always be brought to class, preferably kept in a notebook along with your notes or on your laptop. Again, you will need information from the handouts and notebook for exams, and even for the unannounced pop quizzes.

Description and Assessment of Assignments

There will be homeworks throughout the semester. Material on quizzes, prelims (there are two "midterms") and the final will be heavily related to the homeworks. Thus, although the homeworks are not required, it is generally advisable to do them. All exams will be open book, but limited in time. This means that books and notes may be brought into the exam, ***but previous exams, quizzes or finals are not allowed***. You may bring a homework which you have worked out, *but not a homework answer sheet from the web*. Possession of a previous exam or quiz while taking an exam will disqualify the exam. Too many students have counted on these in the past, instead of doing the homework, and the result has been a drop in the average grades! (You are encouraged to study using these materials before the exams, but you may not bring them into the exam with you. If you find that you have such materials among your notes, you must immediately take them out and place them upside down on the floor in front of you for the duration of the exam.)

Grading Breakdown

The grade for the semester will be based on the following percentages:

3 Pop quizzes @ 10% each	30%
2 Midterms @ 20%	40%
Final Exam	30%
	100%

Assignment Submission Policy

Assignments are issued in class and are due at the beginning of the following class. Assignment grades are used for reference only and as a guide for students. The quizzes, midterms and Final Exam determine the grade, as noted above.

Additional Policies and Support

Disabilities

Over the years we have had many students in the course with various disabilities and have had excellent experiences thus far. 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 Prof. Schiler as early in the semester as early as possible. DSP is located in GFS 120 (Grace Ford Salvatori Hall), 3601 Watt Way. The phone number for DSP is (213) 740-0776. Email is ability@usc.edu. See https://osas.usc.edu/

Critical Dates and Religious Observances:

The university 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.

Disruptive Behavior

Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office of Student Judicial Affairs and Community Standards for disciplinary action.
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 only 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 SCampus, Part B, Sections 11.00 – 13.20).

Professional Degree:

The USC School of Architecture's five-year BArch degree is an accredited professional architectural degree program. All students can access and review the NAAB Conditions of Accreditation (including the Student Performance Criteria) on the NAAB Website, http://www.naab.org/accreditation/2004_Conditions.aspx.

Attendance

Attending classes is a basic responsibility of every USC student who is enrolled in courses at the School of Architecture. Regular and punctual class attendance is considered an essential part of satisfying the NAAB accreditation requirements therefore attendance will be taken at every class session. A student may miss up to two class sessions without directly affecting their grade and ability to complete the course if they provide an excused absence for any confirmed personal illness/family emergency/religious observance. For each absence over that allowed number, the student's letter grade is in danger of being lowered up to one full letter grade. Any student not in class within the first 10 minutes is considered tardy, and any student absent for more than 1/3 of the class time can be considered fully absent. If arriving late, a student must be respectful of a class in session and do everything possible to minimize the disruption caused by a late arrival. It is always the student's responsibility to seek means to make up work missed due to absences. Being absent on the day of a quiz or exam will lead to an "F" for that quiz or exam. Thus missing a quiz drops the final grade by one letter. This is a direct and intentional byproduct of bad attendance.

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 Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

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/department/department-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.

Support Systems

Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students.

The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations.

If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* *http://emergency.usc.edu/* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Course Outline

COURSE SCHEDULE

Section 1 Lighting, Lauren Dandridge-Gaines

1	**January 10, 2023**	**Tuesday**
	Lecture 01 - Lighting Fundamentals and Basic Perception	
	Recommended Reading	Grondzik Chapter 11.15-11.29, Lechner Chapter 12.1 – 12.3, Schiler Chapter 1.1
	Homework Due Today	None
2	**January 12, 2023**	**Thursday**
	Lecture 02 - Physics of Light and Color	
	Recommended Reading	Grondzik Ch 11.34-11.39, Lechner Ch 12.1 – 12.3, Schiler Ch 1.2, 2.1-2.6
	Homework Due Today	Homework #1
3	**January 17, 2023**	**Tuesday**
	Lecture 03 - Light Sources, Lamps and Fixtures	
	Recommended Reading	Grondzik Chapter 12, Schiler Chapter 3
	Homework	Homework #2
4	**January 19, 2023**	**Thursday**
	Lecture 04 - Designing with Artificial Light, Equipment, Point Grid	
	Recommended Reading	Grondzik Ch 15.1-15.12 & 16.1-16.30
	Homework	Homework #3
5	**January 24, 2023**	**Tuesday**
	Lecture 05 - Calculating Light-Lumen Method/ Applications	
	Recommended Reading	Grondzik Chapter 15.18-15.32
	Homework	Homework #4
6	**January 26, 2023**	**Thursday**
	Lecture 06 - Basic Electricity and Dimming	
	Recommended Reading	TBD
	Homework	None

7	**January 31, 2023** **Lecture 07 - Designing with Daylight**	**Tuesday**
	Recommended Reading	Grondzik Chapter 14
	Homework	Homework #5
8	**February 2, 2023** **Lecture 08 Lighting Applications (Guest Lecture)**	**Thursday**
	Recommended Reading	None
	Homework	Prepare for prelim exam
9	**February 7, 2023** **Quiz 01 (Given at an earlier date in this section)**	**Tuesday**
	Recommended Reading	None
	Homework	None
10	**February 9, 2023** **Preliminary Exam #1**	**Thursday**
	Recommended Reading	Section 1 Recap
	Homework	None

Section 2: Acoustics, Elizabeth Valmont-Harrington

11	**February 14, 2023** **Lecture 9 - Acoustic Basic Theory and Perception**	**Tuesday**
	Recommended Reading	Egan Chapter1, pp 1-11
	Homework	None
12	**February 16, 2023** **Lecture 10 - Acoustic Field Trip to the Music Center (can be moved to a different date, if necessary)**	**Thursday**
	Recommended Reading	Egan Chapter 1, pp 12-36
	Homework	Homework #6
13	**February 21, 2023** **Lecture 11 - Acoustic Physics and Calculations**	**Tuesday**
	Recommended Reading	Egan Chapter 2
	Homework	Homework #7

14	**February23, 2023** **12 - Architectural Acoustics – Sound Isolation**	**Thursday**
	Recommended Reading	Egan Chapter 4
	Homework	Homework #8
15	**February 28, 2023** **13 - Architectural Acoustics – Sound Absorption**	**Tuesday**
	Recommended Reading	None
	Homework	Homework #9
16	**March 2, 2023** **14 - Principles of Performance Acoustics**	**Thursday**
	Recommended Reading	None
	Homework	None
17	**March 07, 2023** **15 – Acoustic applications (Guest Lecture)**	**Tuesday**
	Recommended Reading	
	Homework	None
18	**March 9, 2023** **Quiz 02 (Given at an earlier date in this section)**	**Thursday**
	Recommended Reading	review notes for this segment
	Homework	None

March 15
Spring Break

March 17
Spring Break

Section 3: Schiler: Building Systems (including Fire Protection, Electrical, Water, Conveyances, ADA)

19	**March 21, 2023** **16 Plumbing Basic Principles: Supply and Demand**	**Tuesday**

	Recommended Reading	Grondzik and Kwok– Chapter 18, 19
	Homework	None
20	**March 23, 2023** **Prelim 02**	**Thursday** **review notes for Acoustics**
	Recommended Reading	review notes for this segment
21	**March 28, 2023** **17 Plumbing Systems and Design: Storm and Wastewater, Recycling.**	**Tuesday**
	Recommended Reading	Grondzik and Kwok– Chapter 20
	Homework	Homework #10
22	**March 30, 2023** **18 Electrical Systems Basic Principles**	**Thursday**
	Recommended Reading	Grondzik and Kwok– Chapter 25
	Homework	None
23	**April 4, 2023** **19 Electrical Systems (Guest)**	**Tuesday**
	Recommended Reading	Grondzik and Kwok– Chapter 25
	Homework	Homework #11
24	**April 6, 2023** **20 Fire Life Safety Basic Principles, or review HVAC systems**	**Thursday**
	Recommended Reading	Grondzik and Kwok– Chapter 25
	Homework	None
25	**April 11, 2023** **21 Fire Protection Systems Design**	**Tuesday**
	Recommended Reading	Grondzik and Kwok– Chapter 24
	Homework	Homework #12
26	**April 13, 2023** **22 Movement Systems, Elevators, Escalators**	**Thursday**
	Recommended Reading	Grondzik and Kwok Chapter 32, 33, 34

	Homework	None
27	**April 18, 2023** **23 Elevators (Guest lecture)**	**Tuesday**
	Recommended Reading	Grondzik and Kwok– Chapter 14
	Homework	Homework #13
28	**April 20, 2023** **24 Americans with Disabilities Act**	**Thursday**
	Recommended Reading	https://www.access-board.gov/buildings.html
	Homework	None
29	**April 25, 2023** **Quiz 02 (Given at an earlier date in this section)** **Extra Credit due**	**Tuesday**
	Recommended Reading	None
	Homework	None
30	**April 27, 2023** **Selected Extra Credit Presentations**	**Thursday**
	Recommended Reading	None
	Homework	None
31	**FINAL EXAM** **Thursday, May 4, 2023, 2-4 p.m.**	

ACCREDITATION STATEMENT

The USC School of Architecture's five-year Bachelor of Architecture Program and Master of Architecture Program are accredited the National Architecture Accreditation Board (NAAB). Conditions for accreditation can be found here: https://www.naab.org/wp-content/uploads/2020-NAAB-Conditions-for-Accreditation.pdf.

Course Responsibilities:

As a required course for an accredited professional degree program, this course holds students accountable for the demonstration of assigned Program Criteria or Student Criteria as defined by NAAB. The accreditation process will require evidence that students achieving a passing grade have attained satisfactory levels of understanding or ability for certain criteria.

Program Criteria: This course has responsibilities within the program to demonstrate the following Program Criteria:

- *PC.3 Ecological Knowledge and Responsibility—How the program instills in students a holistic understanding of the dynamic between built and natural environments, enabling future architects to mitigate climate change responsibly by leveraging ecological, advanced building performance, adaptation, and resilience principles in their work and advocacy activities.*
- *PC.5 Research and Innovation—How the program prepares students to engage and participate in architectural research to test and evaluate innovations in the field.*

The above Program Criteria for this course are demonstrated through curricular activities and course materials (syllabi, lectures, assignments, etc.).

- *SC.1 Health, Safety, and Welfare in the Built Environment—How the program ensures that students understand the impact of the built environment on human health, safety, and welfare at multiple scales, from buildings to cities.*
- *SC.3 Regulatory Context—How the program ensures that students understand the fundamental principles of life safety, land use, and current laws and regulations that apply to buildings and sites in the United States, and the evaluative process architects use to comply with those laws and regulations as part of a project.*
- *SC.4 Technical Knowledge—How the program ensures that students understand the established and emerging systems, technologies, and assemblies of building construction, and the methods and criteria architects use to assess those technologies against the design, economics, and performance objectives of projects.*

The above Student Criteria SC1.-SC.4 are brought up to the understanding level. See required readings, lecture materials, demonstrations, movies, and other materials used in the course to achieve the intended learning outcomes. There are 3 quizzes, 2 Midterm Exams and a Comrehensive Final Exam.

- *SC.6 Building Integration—How the program ensures that students develop the ability to make design decisions within architectural projects while demonstrating integration of building envelope systems and assemblies, structural systems, environmental control systems, life safety systems, and the measurable outcomes of building performance.*

SC.6 will be evaluated at the ability level. The course will collect all passing student work in which the learning outcomes associated with this criterion are achieved. All student work, verbal, mathematical and graphic will be collected on Blackboard.