

ARCH 6810 – AUTUMN 2014

ENVIRONMENTAL, MECHANICAL & ELECTRICAL SYSTEMS IN ARCHITECTURE 2

Knowlton School of Architecture
The Ohio State University

8:00-9:20 AM Tuesdays and Thursdays, Knowlton 177

Andrew Cruse, AIA NCARB LEED^{AP}
Knowlton 235. Office Hours by appointment
cruse.40@osu.edu

Terry Sullivan AIA PE LEED^{AP}
Phone: 614-628-0300 (daytime)
Cell: 614-203-2429 (until 12:00AM)

Graduate Teaching Assistant
Danielle Maludy
maludy.1@osu.edu

COURSE DESCRIPTION

In this class you will explore buildings' thermal, luminous and acoustic environments. We will do this by first reviewing the basic concepts of each type of environment, and then looking at examples of how these concepts are put into practice. There are two principal goals for the class. First, to bring issues of energy and sustainability to bear on architectural design. Second, to help prepare students for the professional practice of architecture, where the architect leads a team of building professionals.

In the Thermal Environment section, we will cover the principles of heat flow, psychometrics, cooling and HVAC distribution. We will also review issues related to climate, site and building envelope, and discuss hybrid (active/passive) approaches to the thermal environment. During this section of the class, you will work with Climate Consultant Software.

In the Luminous Environment section, we will review the basic principals of electricity, understand basic daylighting strategies, and principles of artificial lighting, as well as making basic lighting calculations. During this section, we will have a field trip to Nela Park, and a lecture from a lighting designer.

In the Acoustic and other Environments section, we will review the basics of acoustic, as well as covering issues related to plumbing, fire protection, vertical transportation, and life cycle cost analysis.

Course Structure

This class will meet Tuesdays and Thursdays from 8:00 until 9:20. Typically, Professor Sullivan will give the Tuesday lecture, and Professor Cruse will give the Thursday lecture. Professor Sullivan will give a view of the concepts and principles behind each week's topic. Professor Cruse will demonstrate how the principles are put into practice, and illustrate these ideas with examples. At the end of each section, there will be a quiz on that section's material. There will also be a final project due at the end of the semester.

Course Materials

For the class you are required to have Stein and Reynolds *Mechanical and Electrical Equipment for Buildings*, Wiley: New York. There are many editions of this text. Reading in the course schedule refer to the most current edition.

Additional readings will be posted to Carmen.

COURSE EVALUATION AND GRADING

Final grades will be based on the following weighting of assignments:

- 20% Thermal Environment Exam
- 20% Luminous Environment Exam
- 20% Acoustic Environment Exam
- 40% Class project

COURSE POLICIES

- Readings must be completed before class;
- Attendance is mandatory for the scheduled duration of class periods. Arriving late or leaving early, unless authorized by the instructor, will be considered an unexcused absence. More than two unexcused absences may constitute grounds for reducing your final grade. Alert your instructor if you know that you will miss a class session for either academic or personal reasons;
- Sexual Harassment: OSU's Sexual Harassment policy, which applies to all faculty, staff and students, includes lewd remarks and inappropriate comments made in the studio environment, classrooms and computer labs, as well as the "display of inappropriate sexually oriented materials in a location where others can see it." Students can file a complaint by contacting Student Judicial Affairs at 292-0748. Sanctions include reprimand, suspension and dismissal from the university;

- **Students with Disabilities:** If a student requires accommodation for a disability, he or she should immediately arrange an appointment with the professor at the Office for Disability Services. At the appointment, the professors, disability councilors and the student can discuss the course format, anticipate needs and decide upon accommodations. Professors rely on the Office for Disability Services for assistance in verifying the need for accommodations and developing accommodation strategies;
- **Academic Misconduct:** It is critical that you take responsibility for your academic work. It is expected that all work will be done with honesty and rigor. You are encouraged to read the Ten Suggestions for Preserving Academic Integrity (<http://oaa.osu.edu/coamtensuggestions.html>). You are required to familiarize yourself with the Code of Student Conduct, which covers academic and social misconduct issues(<http://studentaffairs.osu.edu/csc/>).

COURSE SCHEDULE

Assignments and Required Readings must be completed prior to class. MEEB is an abbreviation for the textbook, *Mechanical and Electrical Equipment for Buildings*

This schedule is subject to change.

Week 1 - Introduction

8.28 Topic: Course introduction and overview (Cruse and Sullivan)

Week 2 – Thermal Environment 1

9.2 Topic: Heat Gain in Buildings (Sullivan)

Required Readings: *MEEB* - 8.1 through 8.14

9.4 Topic: From Climate to Comfort (Cruse)

Required Readings: Banham “Environmental Management”
Heschong “Necessity”
Olgay “Design with Climate-Introduction”
Rudofsky “Architecture without architects” Images only

Week 3 – Thermal Environment 2

9.9 Topic: The Opaque Envelope (Cruse)

Required Readings: *MEEB* – 7.1 through 7.4

9.11 Topic: Psychometrics & Human Comfort (Sullivan)

Required Readings: *MEEB* – Chapter 4

Week 4 – Thermal Environment 3

9.16 Topic: Refrigeration & Mechanical Cooling (Sullivan)

Required Readings: *MEEB* – 9.1 through 9.6, 9.8 & 9.9

9.18 Topic: The Transparent Envelope (Cruse)

Required Readings: *MEEB* – 7.5 through 7.9
Mazria “Shading Calculator”

Week 5 – Thermal Environment 4

9.23 Topic: HVAC Distribution (Sullivan)

Required Readings: *MEEB* – Chapter 10

9.25 Topic: Climate-inflected Buildings (Cruse)

Required Readings: Fernandez –Galliano “Thermal Space in Architecture”
Ingels “Engineering without Engines”

Week 6 – Luminous Environment 1

9.30 **EXAM 1** - Thermal Environment

10.2 Topic: Principles of Lighting (Cruse)

Required Readings: Lam “Delightful, Healthful, Luminous Environment”
Lam “Light and its Control”

Week 7 – Luminous Environment 2

10.7 Topic: Principles of Electricity 1 (Sullivan)

Required Readings: *MEEB* – Chapter 25, 26.6 through 26.13

10.9 Topic: Types of Lighting (Cruse)

Required Readings: Lam “Sidelighting”
Bougdah “Artificial Lighting Principles”

Week 8 – Luminous Environment 3

10.14 Topic: Principles of Electricity 2 (Sullivan)

Required Readings: *MEEB* 26.38 & 26.39, 28.1 through 28.5

10.16 Topic: NELA Park Tour **THIS IS AN ALL-DAY EVENT FROM 6:30 AM TO 6:30 PM**

Week 9 – Luminous Environment 4

10.21 Topic: Ardra Zinkon Talk

Required Readings: TBD

10.23 Topic: PV and Solar, visit to OSU Solar-Powered House Lab

Week 10 – Luminous Environment 5

10.28 Topic: Lighting Calculations (Sullivan)

Required Readings: *MEEB* – Chapter 15

10.30 **EXAM 2** - Luminous Environment

Week 11 – Acoustic and other Environments 1

11.4 Topic: Acoustics 1 (Sullivan)

Required Readings: *MEEB* 17.1 through 17.6, 19.1 through 19.13

11.6 Topic: Acoustics 2 (Cruse)

Required Readings: Bougdah “Sound”
Rasmussen “Hearing Architecture”

Week 12 – Acoustic and other Environments 2

11.11 **Veteran’s Day Holiday – No Class**

11.13 Topic: Water and the Building Site (Cruse)

Required Readings: Kwok “Site Water Strategies”
Lynch “Site Form and Site Ecology”

Week 13 – Acoustic and other Environments 3

11.18 Topic: Plumbing (Sullivan)

Required Readings: *MEEB* – 21.1 through 21.6, 22.1 through 21.6

11.20 Topic: Vertical Transportation (Cruse)

Required Readings: Vertical Transportation Readings

Week 14 – Acoustic and other Environments 4

11.25 Topic: Fire Protection and Detection (Sullivan)

Required Readings: *MEEB* Chapter 24

11.27 **Thanksgiving Holiday – No Class**

Week 15 – Conclusion

12.2 Topic: Life Cycle Cost Analysis and Return on Investment (Sullivan)

Required Readings: *MEEB* pp. 1701-4 and PDF readings

12.4 **EXAM 3** - Acoustic Environment

Week 16

12.9 Topic: Conclusion (Cruse and Sullivan)

Deadline for final project: 12:00 noon Wednesday December 10.