Environmental Control Systems II

ARCH 5326 Environmental Control Systems II: building Ecology
Spring 2010, Tuesdays 1:30pm-4:20pm, Architecture Building Rm. 204

Prerequisite: ARCH 5325
Credit Hours: 3
Issued: 19 January 2010

The University of Texas at Arlington School of Architecture
Professor Albert Marichal

O: Tuesdays, 4:00pm-5:00pm, Rm. 316
E: marichal@uta.edu
M: Box 19108
T: 817+272-5074
F: 817+272-5098

“The difficulty of an Architect’s task is … to be able to work with the material of the measurable and the sayable in order to transcend them.”

Kenneth Frampton, Cubit Symposium, Texas A&M University, 1990

Professor Frampton remarked the above task of the Architect, while referring to both Wittgenstein’s concept of the sayable and the unsayable and to Kahn’s idea of the measurable and the unmeasurable.

Ecology [i-kol-uh-je] noun 1. the branch of biology dealing with the relations and interactions between organisms and their environment, including other organisms.

Building Ecology: a Proposition
Mankind’s primordial purpose for building is shelter. Shelter provides mankind with cover or protection. However, shelter does not merely provide cover or protection from the elements, other men, other dangers, etcetera; shelter also provides mankind with a refuge; a haven. A refuge is a source of help, relief, or comfort. A haven is a harbor, an anchorage, a sanctuary; a sacred place; a meaningful place.

The making of architecture is inherently the making of environmental control systems. The Environmental Control Systems course is essentially about Building Ecologies. The use of the term building implies on the one hand, creating, making or constructing and on the other hand a completed edifice or system. The term ecology includes both natural and man-made elements. The phrase Building Ecology implies both an architectural ecology and an urban ecology. An architectural ecology may imply the relations and interactions between buildings and the natural environment, including buildings and the natural elements as well as buildings and people, while an urban ecology may imply relations and interactions between buildings and the man-made environment, including buildings and buildings.
The creation of an environment is essentially the creation of a physical condition that affects the human body in the phenomenological sense, that is: both physical and psychological, via visual, tactile [haptic], aural, olfactory, and even gastronomic [taste] sensorial experiences.

In the last century of so-called modernization, advancements in technology, especially the advent of air-conditioning systems, and an assumption of plentiful and inexpensive natural resources created a division between building form and building performance; hermetic buildings, with large windowless enclosures, single-glazed skins executed equally on each of four orientations, and based primarily on aesthetics and whim prevailed. So-called primitive, pre-industrialized cultures have for centuries developed a sensible regional vernacular in response to climate, context, and comfort. They have long understood the notion that buildings are inherently performative and that building systems are inherently integral to buildings. In a contemporary world of 'inconvenient truths' revealed: global warming, pollution, energy blackouts, sick building syndrome, and global wars over natural resources, architects are reexamining the potential relationships between building performance and building beauty.

Course Description
Illumination, acoustics, climate controls, mechanical and electrical systems, and their significance in the total design.

Course Methodology
Via a series of lectures, exercises, class discussions, quizzes, projects, and a final exam that combine the investigations of theoretical texts, scientific principles, and canonical design works, this course will examine the philosophical, technological, and cultural contexts that have affected the design strategies of meaningful places through considerations of the natural and the man-made world.

Course Goals & Objectives
This course intends to satisfy the minimum NAAB student performance criteria listed later in this syllabus.

Course Requirements
In addition to required readings, this course will include a series of quizzes, two major projects, and a final exam. Required readings must be completed prior to class time for the dates they are listed on in this syllabus. With few exceptions, a quiz covering required readings and/or material previously discussed in class will be issued at the commencement or the conclusion of each class period. Timeliness and full-time attendance will be imperative for the successful completion of quizzes. Make-up quizzes will not be offered for unexcused tardiness or absences. The first major project will be an in-depth case-study analysis including large-scale drawings and a large-scale model to be completed in groups while the second major project will entail the design of a small shelter to be completed individually. A comprehensive final exam will be offered at the end of the course.

Course Materials
Following the tripartite structure of the course, emphasizing theory, technology, and poetics, the following three texts are required and available at the University Bookstore:


Students will be required to maintain an 8 ½” x 11” binder dedicated to their work in the course. Course notes, handouts, assignments, and quizzes should be compiled in the binder.

Additional required readings from the course bibliography will be issued via electronic mail and are required to be printed by each student and maintained in their course binder.

Ecotect, a proprietary software acquired by Autodesk in 2008 for use in building performance analysis, will be presented in the course. Students are encouraged to obtain an educational version of the software.
Attendance
Attendance is required for the full class time. This course meets on Tuesdays from 1:30pm to 4:20pm. Excused absences from class meetings for medical reasons or religious observance must be verified with the course professor. Acceptable 'excused' absences approved by the course instructor, for reasons such as medical, etc., will be limited to two per student. Excessive absences will be considered grounds for failure, withdrawal, or a reduction of a student's final grade.

Grades
Final grades for the course will be based on the following assessment of a student's work:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>30%</td>
</tr>
<tr>
<td>Case-Study Project</td>
<td>30%</td>
</tr>
<tr>
<td>Primitive Hut Project</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
</tbody>
</table>

A Excellent [Scores 90-100] Exceptional and/or unusually outstanding work. Exceptional performance exceeding requirements of the assignment; initiative proving independent resourcefulness; strong positive attitude towards the work; growing level of improvement.

B Good [Scores 80-89] Very strong work. Adequate performance above the norm, accurate and complete beyond requirement of the assignment; good initiative; growing level of improvement.

C Fair [Scores 70-79] Average work. Conservative performance satisfying all requirements of the assignments with a neutral or ordinary level of initiative, attitude, and improvement.

D Passing, Below Average [Scores 60-69] Weak work. Inadequate performance not satisfying the requirements of the assignment with an indifferent and unnoticeable level of initiative, attitude, and improvement.

F Failure [Scores 0-59] Unacceptable or incomplete work. Ineffective performance not satisfying the requirements of the assignments; Very low level of initiative attitude, and improvement.

Grades will be issued regularly as the course progresses so that at any point in the semester it should be possible for each student to calculate his/her status in the course. It is strongly recommended that students keep apprised of their status in the course and calculate their standing and final grade potential regularly, but especially before the last day to drop this course: Friday, 2 April 2010.

Performance evaluations will be issued at approximately mid-term, before the last day to drop this course. If at any time during the semester, a student would like to discuss his/her progress in the course, he/she is welcome to make an appointment with the professor during posted office hours. Special provisions will not be made for extra credit or additional time to complete work at the end of the course.

Communication Policy
The official, primary mode of communication for this course is via electronic mail, not faculty mailboxes or faculty telephone lines, etcetera. Students are required to check and manage their e-mail accounts regularly.

Laptop Policy
The School of Architecture requires each student in the Master of Architecture graduate program to have a personal laptop computer configured to the School's specifications. For more information, please see http://www.uta.edu/architecture/admissions/laptop.htm.

Food & Personal Electronic Devices
No food is permitted in the classroom. Unless specifically permitted by the course professor, personal electronic devices such as laptop computers, mobile phones, cameras, and recorders must be powered off and stowed while in the classroom.

Master Craftsmanship
As noted in Richard Sennett's book, The Craftsman, the development of any craft to the level of mastery, is a labor/time intensive pursuit; this point cannot be understated regarding the time and commitment required to successfully complete a graduate level course required for a professional degree.
Outside Employment
The School of Architecture advises students in the Path A Master of Architecture program to discontinue outside employment due to the rigor of the program (not unlike any other professional school in law or medicine). For more information, please see http://www.uta.edu/architecture.

Student Work
It is understood that the course instructor and the School of Architecture, in compliance with the Federal Family Educational Rights and Privacy Act and all other applicable laws or University policies, may make use of originals or reproductions of student work produced for this course as required for educational purposes. It is understood that registration for and continued enrollment in this course where such use of student work is announced constitutes permission authorized by the student.

Classroom Culture
The faculty and students are required to treat one another with dignity and respect in the classroom, on project reviews, and in all course related communications.

Student Support Services
The University of Texas at Arlington supports a variety of student success programs to help students connect with the University and achieve academic success. These programs include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs at 817-272-6107 for more information and appropriate referrals.

For assistance with your library needs in this course, please consult the appropriate subject librarian.

University Policy on Academic Dishonesty
The University of Texas at Arlington policy on academic dishonesty holds students accountable for the integrity of the work they submit. Students should be familiar with the university policy and know that it is their responsibility to learn about academic expectations with regard to proper citation of sources in written work. The policy also governs the integrity of work submitted in exams and assignments as well as the veracity of signatures on attendance sheets and other verifications of participation in class activities.

“Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.” [Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22].

It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Serious sanctions can result from academic dishonesty of any sort; discipline may include suspension or expulsion from the University.

University Policy on Disability-Related Accommodations
The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112, The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act (ADA), pursuant to section 504 of The Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide “reasonable accommodation” to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels.

Disclaimer
The course professor reserves the right to issue course amendments via updated syllabi from time to time.
Course Lecture & Assignment Schedule

PART I: WHO BUILDS? WHEN DO WE BUILD? WHY DO WE BUILD? theoretical context/building ecology/making place

Wk. 1 1/19  building Performance
Introduction to the Theoretical Context and Structure of the Course/The Concept of Shelter/Building Ecology/ making Place/Macro & Micro Eco-Systems/Sustainability & LEED/Embodied Energy/An Inconvenient Truth/Professor and Student Introductions
Theory: Genius Loci [Recommended]
Technology: HCL-1 Heating Cooling and Lighting as Form-Givers in Architecture
HCL-2 Sustainable Design
Poetics: Albert Marichal Studio

PART II: WHERE DO WE BUILD? HOW DO WE BUILD? concepts/principles/science & technology

Wk. 2 1/26 building Heat
Theory: Thermal Delight in Architecture pp.1-30
Technology: HCL-3 Basic Principles
HCL-4 Thermal Comfort

Wk. 3 2/2  building Climate
Theory: Critical Regionalism
Technology: HCL-5 Climate
HCL-11 Site Design, Community Planning, and Landscaping

Wk. 4 2/9  building Sun-Light
Technology: HCL-6 Solar Geometry
HCL-9 Shading and Light Colors
HCL-13 Daylighting

Wk. 5 2/16  building Comfort I
Technology: HCL-7 Passive Solar
HCL-10 Passive Cooling

Wk. 6 2/23  building Skins [Case-Study Projects Issued]
Technology: HCL-15 The Thermal Envelope: Keeping Warm and Staying Cool

Wk. 7 3/2  building Power
Technology: HCL-8 Photovoltaics and Active Solar

Wk. 8 3/9  building Water

Wk. 9 3/16  building Break [Spring Recess]

Wk. 10 3/23  building Structures [Case-Study Projects Due]
8th Annual Building Science Exposition, UTA

Wk. 11 3/30  building Comfort II [Progress Reports Issued]
Technology: HCL-16 Mechanical Equipment for Heating and Cooling

Wk. 12 4/6  building Electric-Light [Primitive Hut Project Issued]
Technology: HCL-12 Lighting
HCL-14 Electric Lighting

Wk. 13 4/13  building Acoustics
Theory: Experiencing Architecture
Technology: Architectural Acoustics

Wk. 14 4/20  building Access & Egress

PART III: WHAT DO WE BUILD? culture/poetics/practice

Wk. 15 4/27  building Shelters [Primitive Hut Projects Due]

Wk. 16 5/4  building Systems

Wk. 17 5/11  building Exam [Final Examination [date & time to be confirmed]]
Select Course Bibliography

THEORY: I


Pallasmaa, Juhani  The Eyes of the Skin: Architecture and the Senses  Chichester, West Sussex: John Wiley and Sons, 2005.


TECHNOLOGY: II


National Architectural Accrediting Board: Student Performance Criteria

The Master of Architecture accredited degree program must ensure that each graduate possesses the knowledge and skills defined by the criteria set out below. The criteria encompass two levels of accomplishment:

- **Understanding** means the assimilation and comprehension of information without necessarily being able to see its full implication.
- **Ability** means the skill in using specific information to accomplish a task, in correctly selecting the appropriate information, and in applying it to the solution of a specific problem.

Students must demonstrate understanding or ability in the following areas:

1. **Speaking and Writing Skills**
   Ability to read, write, listen, and speak effectively.

2. **Critical Thinking Skills**
   Ability to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test them against relevant criteria and standards.

3. **Graphics Skills**
   Ability to use appropriate representational media, including freehand drawing and computer technology, to convey essential formal elements at each stage of the programming and design process.

4. **Research Skills**
   Ability to gather, assess, record, and apply relevant information in architectural coursework.

5. **Formal Ordering Systems**
   Understanding of the fundamentals of visual perception and the principles and systems of order that inform two- and three dimensional design, architectural composition, and urban design.

6. **Fundamental Design Skills**
   Ability to use basic architectural principles in the design of buildings, interior spaces, and sites.

7. **Collaborative Skills**
   Ability to recognize the varied talent found in interdisciplinary design project teams in professional practice and work in collaboration with other students as members of a design team.

8. **Western Traditions**
   Understanding of the Western architectural canons and traditions in architecture, landscape and urban design, as well as the climatic, technological, socioeconomic, and other cultural factors that have shaped and sustained them.

9. **Non-Western Traditions**
   Understanding of parallel and divergent canons and traditions of architecture and urban design in the non-Western world.

10. **National and Regional Traditions**
    Understanding of national traditions and the local regional heritage in architecture, landscape design and urban design, including the vernacular tradition.

11. **Use of Precedents**
    Ability to incorporate relevant precedents into architecture and urban design projects.

12. **Human Behavior**
    Understanding of the theories and methods of inquiry that seek to clarify the relationship between human behavior and the physical environment.

13. **Human Diversity**
    Understanding of the diverse needs, values, behavioral norms, physical ability, and social and spatial patterns that characterize different cultures and individuals and the implication of this diversity for the societal roles and responsibilities of architects.

14. **Accessibility**
    Ability to design both site and building to accommodate individuals with varying physical abilities.

15. **Sustainable Design**
    Understanding of the principles of sustainability in making architecture and urban design decisions that conserve natural and built resources, including culturally important buildings and sites, and in the creation of healthful buildings and communities.

17. **Site Conditions**
    Ability to respond to natural and built site characteristics in the development of a program and the design of a project.

19. **Environmental Systems**
    Understanding of the basic principles and appropriate application and performance of environmental systems, including acoustical, lighting, and climate modification systems, and energy use, integrated with the building envelope.
20. Life Safety
Understanding of the basic principles of life-safety systems with an emphasis on egress.

21. Building Envelope Systems
Understanding of the basic principles and appropriate application and performance of building envelope materials and assemblies.

22. Building Service Systems
Understanding of the basic principles and appropriate application and performance of plumbing, electrical, vertical transportation, communication, security, and fire protection systems.

23. Building Systems Integration
Ability to assess, select, and conceptually integrate structural systems, building envelope systems, environmental systems, life-safety systems, and building service systems into building design.

24. Building Materials and Assemblies
Understanding of the basic principles and appropriate application and performance of construction materials, products, components, and assemblies, including their environmental impact and reuse.

26. Technical Documentation
Ability to make technically precise drawings and write outline specifications for a proposed design.

34. Ethics and Professional Judgment
Understanding of the ethical issues involved in the formation of professional judgment in architectural design and practice.