SUS 7600A: Perspectives on Sustainable Materials

Instructor: Susan Kaplan, LEED AP, CSI, CCS, MAI. skaplan@hlw.com.

Time/Place: Wednesdays, 5:00-7:40pm, Architecture 2M11A/B.

General Description: This course provides students with a critical understanding of practicing responsible architecture and engineering from a materials and products perspective. It will cover a full range of complex issues involved in the concept of product life cycle and product selection. Starting by reinforcing the student's knowledge of material properties they will learn to make the critical connection between material use and serious health, social, and environmental issues. Using current evaluation tools (Pharos, Quartz, Cradle to Cradle and others) students will research the specific impacts materials and products at each phase of the products life cycle. The class will investigate the link between the lives of building materials and lives of people along the route of a product’s life cycle.

Overview: This course will provide a thorough understanding of the concept of sustainable materials and products. It will cover a full range of complex issues involved in material/product impact and selection. Analysis of the ecological, social, health, and economic impacts of each phase of a products life-cycle will be a major framework for this course. There has been a huge development of “green material/product” tools resulting from the growing awareness of global environmental problems, need for product transparency, and the realization of the impact of certain chemicals on human health. These advances have caused the creation of a great many standards/certifications, conflicting definitions, and frequent unreliable product claims. Through research, hands-on activities, and exchanges with professional experts, students will learn to navigate the abundant body of “green material/product” resources. Students will be taught to focus their “sustainability” efforts in specific meaningful ways.

3 credits; 3 hours/week

Objectives:

Following this course, students will be able to:

1. Prioritize the most important environmental, social, and health impacts of building materials.
2. Assess the global and local implications of using specific materials and products.
3. Successfully employ green material resources and tools.
4. Apply available knowledge to specific contexts in order to make positive choices that promote healthier designs while sustaining the global environment.

Method of Evaluation:

- Basic Material Presentation: 20%
- Mid Term Exam: 20%
- Advanced Material Presentation: 10%
- Final Presentations: 20%
- Final Essays: 20%
- Class Participation: 10%
Primary Assignments:

- **Basic Material Presentation**: Using textbooks, the internet and articles, students will describe the characteristics of basic materials that form the fundamentals of most building materials, e.g., glass, masonry, textiles, stone, plastics, etc.

- **Midterm Exam**: Given as a gauge to measure how successfully the students have integrated the concepts of ecology and material life cycles. The essay portion of the exam should help reinforce the ability to discuss and analyze related issues.

- **Advanced Material Presentation**: Using on-line resources, textbooks, and articles, students will choose a material/product that is both innovative and has sustainable implications. They will report their findings.

- **Final Presentation**: Students will do one of the following.
  - Create a small design project and determine 5 materials that would be good environmental choices. The whole process of determining choice must be disclosed.
  - Choose one specific product and trace its entire actual life cycle and show the environmental, economic, and social implications of its use at each stage of its life.

Approximate Course Outline:

**Week 1: Introduction to the Course**
Course will begin with:
- Personal introductions
- Description of course process
- Overview of issues of sustainability that will pertain to the entire course

**Week 2: Basics of Life Cycle Thinking**
Primary class discussion will revolve around a viewing of “The Story of Stuff.”
- Analysis of the environmental problems that occur during each life cycle phase of a product.
- Further discussion will continue, relating more directly to human impact by reviewing the Shoe Reading Assignment: Shoe chapter from “The Secret Life of Everyday Stuff.”

**Week 3: Material Basics**
Students will gain understanding of the fundamental environmental issues that relate to basic building materials.
- Introduction to Physical Characteristics: Weight, Compressive strength, Tensile strength, Thermal, Air/Vapor/Moisture.
- Description of approach to concrete will be given as examples.
- Students will be assigned their first project, to report on basic properties and environmental impact for the fundamental building materials.

Week 4: Toxins in Building Materials
- Lecture and discussion during this class will cover the basic definitions of toxins.
- Students will learn why there are toxins in specific materials.
- Emphasis of discussion will be geared to the most prevalent toxins that occur in building materials:
  - PVCs
  - Halogenated fire retardants
  - Heavy metals
  - Perfluorinated Compounds
  - Formaldehyde
  - BPA
- Class will conclude with thoughts on what we can do to create toxin free spaces.


Week 5: Life Cycle Assessment (LCA)
Working with the BEES and Athena software, students will:
- Learn the basic definition of LCAs.
- Review the actual user process of LCA analysis.
- Compare 2 different types of LCAs.
- Begin to understand the problems that can be encountered using LCA system concepts and software.

Week 6: Material Transparency and Material Performance
- Working directly with the on-line Pharos Project students will learn to conquer the intricacies of comparing several products with each other for toxins exposed during use and manufacturing as well as recycled content, VOCs and use of renewable energy.
- Based on present status of EPDs and the newer HPD, students will delve into the topics of product transparency and product performance.
- Bill Walsh founder of Pharos will participate and lead part of class.


Week 7: Midterm Review, Toxins on a personal level
- This class will be dedicated to a review of the first part of term’s work.
- In response to a previous assignment, student stories about toxins that relate to them personally or for which they have a special interest, health problems, countries of origin and local concerns are suggested directions.


Week 8: Midterm and Further Study of Plastic
- Midterm exam.
- Viewing of the Movie “The Plastic Planet” and consequent discussion of the severe impact that plastics have on the environmental health of our planet.
- The Final Project assignments will be clearly defined.

Week 9: Certifications
- Working the assigned reading material, students will explore:
  - Sins of Green Wash
Perspectives on Sustainable Materials, Instructor Susan Kaplan
Fall 2016 Syllabus (subject to refining/updating)

- Types of Certifications
- Types of Standards
- Types of ISO Labels o Multi and Single Attribute Certifications and Standards
- Certifying by Sector, by Attribute

Reading Assignments:

Week 10: LEED v4 and Living Building Challenge (LBC)
- Using current Building Rating in order to learn the typical organization contexts, in which green material requirements are housed.
- Using the LEED v4 and the LBC: Student will analyze the changes from the existing LEED version.

Week 11: Working with Manufacturers, and Asking the Right Questions
- Guest speaker, from the manufacturing sector, will hold a discussion with students about the interaction between designers and manufacturers.
- Defining the Criteria for Environmentally Preferable Products: Reviewing current industry standard descriptions and definitions of environmentally preferable products to ensure consistency of thought and procedures.
- In class, students will begin creating a useable “Sustainable Attribute Product List”

Reading Assignments:

Week 12: Reinforcing Working with Manufacturers and Focusing on the Project
- Class will begin with a review of and finalization of Sustainable Product Attributes List they began the previous week.
- Students will view portions of “The Next Industrial Revolution” to reinforce the process of designers working with manufacturers.
- The class will then take the next step of considering how to focus on project needs in order to prioritize Sustainable Attributes and choose appropriate product for specific conditions.


- Based on assigned readings and web explorations students will discover the world of new or experimental materials, systems, and points of view (Bio-mimicry, “smart materials”, etc.) to support student’s ability to participate in the ever changing world of product development.
- Class will survey how the current array of rating systems, standards, and certifications deals with social justice issues.

Reading Assignment:
• biomimicry.net.
• epa.gov/greenchemistry/pubs/about_gc.html.
• beyondbenign.org/about/about.html.
• Jones, Van, “Plastics and Poor People”, Ted Talks, May 2015

Week 14: Summarizing Understanding and Focus
• In class students will collectively create a matrix of positive characteristics for building materials using life cycle phases as a framework
• In class “scenarios” we will used to focus the choice of sustainable materials on specific vastly different conditions

Week 15: Presentations
Final projects: Each student will have chosen one of the following:
(1) Product Analysis: Student will present full LCA analysis of a specific manufactured product. The environment impact of each component of the product at each phase of the product life will be disclosed at the most detailed level available
(2) Design Application: Student will present in detail how they made a series of choices for a fictional space. Their presentations shall include: LCA investigations, appropriate standard and certification applications, and use of class created Sustainable Attribute list. The presentation must express a clear understanding of the logic behind project focus.

Bibliography:


**Online References and Databases:**

- athenasmi.org
- epa.gov/epp/pubs/products/index.htm
- greenformat.com
- the pharos project.org
- Greenwizard.com
- Ted Talks