

Physics of Sustainable Design

Fall 2020

Syllabus

What is Sustainable Design?

Sustainable design seeks to produce buildings and communities that

- reduce negative impacts on the environment,
- **health** and **comfort** of building occupants,
- improve building performance.
- **reduce consumption of non-renewable resources**
- **minimize waste,**
- **create healthy, productive environments**

Integrated, holistic approach that encourages **compromise** and **tradeoffs** to positively impacts **all phases** of a building's **life-cycle**, including **design, construction, operation** and **decommissioning** without compromising the **bottom line**. (GSA)

Goals of the Course

- Provide an in-depth introduction to the principles and practices of sustainable (or “green”) design of buildings and communities.
- Provide an introduction to the physics and science behind sustainable design
- Demonstrate the importance of a multi-disciplinary approach to solving environmental problems; science, aesthetics, social justice
- Practice in argumentative writing
- Opportunity to exercise personal creativity and collaboration on projects

Course Delivery Format

Daily lectures on zoom 9:30-10:45 am CST Monday – Friday. Typically the first 45-50 minutes will be a PowerPoint presentation, with the remainder of time for discussion and questions..

Scheduled Office hours on zoom TBD (to avoid conflicts with other course)

Individual meetings as arranged

Assignments

- Homework/short projects assigned most classes (**50% of grade**) ; submission format will depend on assignment and will include
 - PowerPoint slides
 - Written assignments (questions/research/reflection)
 - Scanned or photographed problem sets
- Final paper (individual) including feedback on draft (**25% of grade**).
- Final project presentation (groups of 3-4) (**25% of grade**)

Resources

The following texts are required:

1. **Sustainable Design: A Critical Guide** By David Bergman
2. **Cradle to Cradle: Remaking the Way We Make Things** By Willian McDonough and Michael Braungart
3. **From Soap to Cities** by Dio Cramer

There will also be readings posted on Moodle.

All assignments will be posted on Moodle. Submission of assignments will be specified either to Moodle or to a shared Google Drive

Tentative Course Outline

Unit 1: Introduction and Overview (4-5 classes): including examples of SD, indigenous and local practices and an overview of biomimicry

Unit 2: Physical Foundations (8-10 classes): topics include Energy and Thermodynamics, Heat Flow and Insulation, Nature of Light and Life Cycle Analyses and Carbon Footprint

Unit 3: Applications (10-12 classes): topics include Passive Solar Heating, Active Heating and Heat Pumps, Glazing and Daylighting, Artificial Lighting, Ventilation and Air Quality, Energy Efficiency – Solar Water Heating, Energy Efficiency – Photovoltaics, Wind, Energy Storage, Materials and Embodied Energy

Unit 4: Integration (8-10 classes): topics include Building Siting, Building Structure, Cool and Green Roofs, Water Use and Efficiency, Recycling, Aesthetics and Biophilia, Food, Transportation, Green Space, Combined Heating and Power, Microgrids, Equity Issues