**ENGR 4660 / LAND 4660: Sustainable Building Design**
**Fall 2011: Tuesday/Thursday 11:00; Driftmier Room 230**
**Pre-requisites: Third Year Standing, Permission of Department**

**Instructor:** Tom Lawrence
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**Office Hours:** I maintain an "open door" policy; even though the door most times is closed (I like to listen to music while I work). However, it will be appreciated if you contact me in advance to make sure I will be there and so that I can plan for it. Drop ins are welcome, but I may sometimes be involved in other tight deadline activities, so your understanding is appreciated.

**Text:** ASHRAE Green Guide, 3rd Edition, 2010. (Cost ~$57, purchase through direct sale from ASHRAE as student member pricing through Dr. Lawrence).
Also available for iPad at $39.99, see:
http://itunes.apple.com/us/book/ashrae-greenguide/id440543498?mt=11&ls=1

**Supplemental References:**

LEED-2009 for New Construction, -EB (Existing Buildings), - H (Homes), www.usgbc.org
ASHRAE Standard 189.1 www.ashrae.org/greenstandard (page viewer)
International Green Construction Code (IgCC):

**Suggested Outside Readings:** Environmental Design and Construction magazine www.edcmag.com

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

**Warning!** This course will be conducted a little differently than most typical engineering courses. You will be expected (no, required) to keep up with assigned readings and lecture preparation work. There will be very little actual engineering 'calculations' involved with this course; rather we will focus on how to apply the concepts and topics studied to the outside real-world environment. Class discussion is strongly encouraged for all; if you have a naturally quiet or shy personality, don't worry just state your opinions clearly and concisely. This too is preparation for your participation in the real-world job market.

## Course Objectives and Organization

This course presents a detailed study of the design features and process for sustainable (green) commercial and residential buildings. Since the subject of sustainable design requires interdisciplinary thinking and integration of design, the topics covered will themselves be multi-disciplinary. Students will gain an appreciation of the integrated design process for achieving a sustainable building design as well as new technologies that are coming to market that minimize the environmental impact of buildings.

The course also will help prepare the students to think on their own, to independently investigate topics and summarize their findings in the context of a broader picture than just engineering equations or environmental design concepts.

The class sessions will use a variety of techniques and formats. Some will be primarily lecture using PowerPoint and graphics, some will be class discussions of a particular topic (and will be noted in

advance so you will be prepared), some will be class discussion of your findings from investigation study assignments and others will be tours or other field activities.

Successful completion of this course should give you a good start in preparation for taking the LEED exam, if you so desire.

The course has the following overriding objectives. The student should:

(a) appreciate the complex interaction of technical and non-technical decisions and details involved with designing, constructing and operating a 'green' building.
(b) gain an understanding of the key design features in the 5 main technical areas associated with green buildings:
    a. Sites
    b. Water use
    c. Energy use
    d. Materials
    e. Indoor environmental quality
(c) learn and see first-hand how green building and sustainable design techniques are being applied at new buildings on and around the UGA campus
(d) gain an understanding of how these topics fit in with larger issues facing society, such as climate change, etc.

These learning objectives are mapped to the course assessment methods and program outcomes as shown below.

**Course Learning Objectives Matrix**

| Course Learning Objectives | Course Assessment Methods* | Extent of Coverage of Program Outcomes** (ABET Criterion 3) |
|---|---|---|
| *Upon successful completion of this course, the student will be able to:* | | |
| Appreciate the complex interaction of technical and non-technical decisions and details involved with designing, constructing and operating a 'green' building | A, B, D | ax, cxxx, dxxx, ex, fxxx, gxxx, hxxx, jxxx, kx |
| Gain an understanding of the key design features in the 5 main technical areas associated with green buildings | A, B, D | axx, cxx, exx, jxxx, kxx |
| Learn and see first-hand how green building and sustainable design techniques are being applied at new buildings on and around the UGA campus | A, B, D | ax, cxxx, dxx, ex, fxxx, hxx, jxx, kx |
| Gain an understanding of how these topics fit in with larger issues facing society, such as climate change, etc. | A, B, D | dxxx, fxxx, gxxx, hxxx, ix |

* Course Assessment Methods: A – Homework and In-class Exercise; B – Investigation Paper; C – Final Exam; D – Project; E – Student Evaluation
** Extent of Coverage: x – some, xx – moderate, xxx - extensive

ABET EC-2000 Criterion 3 Program Outcomes

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs
d) an ability to function on multi-disciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Overall Course Contribution to Program Outcomes
**c, d, f, g, h, j, k – extensive a, e, i - some**

**Course Prerequisites:** None, other than third year standing.

## Course Topics

The course will cover the following main topical areas (not necessarily in this order and sometimes these are intertwined):

1 Background and introduction to sustainable design concepts
   (a) What is it? Why do it?
   (b) LEED and the coming of green building standards and codes in the marketplace
2 Building design process
   (a) Program → concept → design → construction → occupancy
   (b) Integrated design and opportunities for influencing green design principles
3 Site selection, preparation and finishing
   (a) Building orientation
   (b) Stormwater: control during construction
   (c) Redevelopment (brownfield) versus Greenfield
   (d) Vegetation
   (e) Hardscape
   (f) Stormwater: control after occupancy
4 Building structures and materials

(a) "cradle to cradle" approach

(b) Life Cycle Assessment programs

(c) Overall environmental impact of a building through its life cycle

(d) Material selection for environmental impacts and IEQ

5 Energy using systems

(a) HVAC

(b) Lighting

(c) Energy Modeling of buildings and evaluation of energy savings

6 Water using systems

(a) Internal: Potable and non-potable; conservation; greywater

(b) External: irrigation

(c) Rainfall capture and use

7 Indoor environmental quality

(a) Air

(b) Lighting and visual perception

(c) Noise

(d) Thermal comfort

## Course Project

The class will be broken up into smaller groups, each focusing on one particular real-world application project from the Athens area. More details in separate announcements.

## Course Grading

In-class work 25%
(includes in-class exercises, quizzes, attendance/ participation @5%)
Case study design project 50%
(Periodic progress reviews on the design process, three @ 10% each,
10% for final presentation, 10% for final report)
Independent investigation study 25%
***No final exam***

## General Course Policies

- ***Attendance. Classroom attendance is mandatory.*** Since a good deal of the learning experience will be in the sharing of ideas and concepts among the class, you should be here. If you must be gone for a good reason, contact me in advance and arrangements will be made. Otherwise, we will just assume you don't care about today's class session (and grading will reflect as such).
- ***Exams and Quizzes.*** The course is project and examples oriented and therefore no exams *per se* are scheduled. Short quizzes are scheduled and listed in the course plan below. These will cover the readings and materials discussed in class, and will be short essay or description answer type.

- ***Communication Quality.*** At least 50% of the grade in the course will be based on the quality of communication (written and/or presentation). In industry and the workplace if you can not effectively communicate your results to your supervisor, clients, or co-workers, then you have not completed the task and it never happened.
- ***Participation.*** You are encouraged to ask questions during class regarding any aspects that are unclear to you. This will keep the class interesting for all and aid in learning by all. In addition, you may be called upon to answer questions, to comment on problem solutions, and/or lead discussions related to the lecture material. Demonstrating reasonable participation will require daily preparation and staying current with assignments. Daily observations of your class participation will be made and recorded through the semester and used to determine the participation portion of the final course grade. For each day recorded, 5 points will be given for active participation in the class session, 4 points for attendance only, and 3 points for attendance with some negative such as a late arrival. At the end of the semester, the points are totaled for everyone. The person with the highest total points is assigned a 100% on the participation portion and all others are scaled to that total point level.
- ***Grading.*** Grading will be basically done on the 90/80/70 scale but may be curved based on overall class breakdown.
- ***Ethical Conduct.*** Communication between students in working on in-class exercises and the design project is encouraged. Students are expected to maintain the high ethics of the engineering profession during the course; unethical behavior such as cheating on an exam will be dealt with severely according to the policies and procedures on academic honesty of UGA.

**University and Departmental Policies**

ACADEMIC HONESTY

The University of Georgia seeks to promote and ensure academic honesty and personal integrity among students and other members of the University Community. A policy on academic honesty has been developed to serve these goals. All members of the academic community are responsible for knowing the policy and procedures on academic honesty. The document for academic honesty may be found at the web site for The University of Georgia Office of Senior Vice President for Academic Affairs and Provost.

ENGINEERING PROFESSIONALISM POLICY

Engineers make great contributions to society. Engineering is a very satisfying profession that provides many rewards but is demanding and requires hard work. The engineering profession is governed by a code of ethics. Engineering faculty at UGA expect students to act in a professional manner at all times and develop the work ethics required for a successful engineering career. Engineering students at UGA are responsible for maintaining the highest standards of professionalism and professional practice.

**DEPARTMENTAL GRADING POLICY REGARDING COMMUNICATION SKILLS**

Thirty percent of the grade on all written assignments (lab reports and papers) and oral presentations will be based on quality of communication. Spelling, grammar, punctuation, and clarity of writing are evidence of written communication quality. Enunciation, voice projection, clarity and logical order of the presentation and effective use of visual aids are evidence of oral communication quality.

All academic work must meet the standards contained in "A Culture of Honesty." Students are responsible for informing themselves about those standards before performing any academic work. The link to more detailed information about academic honesty can be found at:
http://www.uga.edu/ovpi/honesty/acadhon.htm